enAble® X1

Power Wheelchair Control System

Technical Manual

Software Version 1.3.1

Notices

Part Number: 53264
Revision: RevD, December 2025

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CAUTION:
Read Instructions Carefully!

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1 — Warnings and Safety Instructions

The symbols below are used throughout this manual and on the wheelchair to identify warnings and important information. It is important that you read and completely understand the warnings and instructions.

WARNING:

Indicates a potentially hazardous condition or situation. Failure to follow designated procedures can cause component damage, malfunction, or personal injury.

MANDATORY:

These actions should be performed as specified. Failure to perform mandatory actions can cause component damage, malfunction, or personal injury.

PROHIBITED:

These actions are prohibited. They should not be performed at any time or under any circumstances. Performing a prohibited action can cause personal injury and/or equipment damage.

Note:

These instructions are compiled from the latest specifications and product information available at the time of publication. Curtis Instruments, Inc. reserves the right to make changes as they become necessary.

The enAble® X1 system meets the following requirements:

- Adheres to WEEE and REACH initiatives
- RoHS compliant
- IPx4 rated (IEC 60529)
- Conforms to the following FCC rules:
    - FCC ID: T7V1326C2
    - IC: 216Q- 1326C2
- Passed EMC testing according to ANSI/RESNA WC-2:2009 Section 21, ISO 7176-21:2009, and IEC 60601-1-2:2007

WARNING:

The system should be maintained and stored in a clean and dry environment. Avoid exposure to rain, snow, ice, salt, or standing water whenever possible.

DISPOSAL:

Contact the OEM for instructions for proper disposal and recycling.

MAGNETIC CONNECTION WARNING:

The charger/programmer connection is magnetic. Use precautions and maintain at least a 6 inch (15cm) separation between the magnetic connection and the following items:

-  Medical implanted devices
- Electronic storage
- Credit and debit cards
- Other similar items

NON-IONIZING RADIATION WARNING:

This device has the following potential risks due to interference from sources of electromagnetic radiation such as cellular phones, RFID, and other medical devices that emit RF signals.

- No Bluetooth connection to third-party devices such as mouse control, emergency calls, voice-over control, or switch control.
- Wireless quality of service interruption during firmware package transmission.
- The system will not be updated. Interruption during parameter modification (not expected system behavior).

2 — System Overview

The enAble® X1 vehicle control system is designed for operation of a power wheelchair. The system features outstanding versatility, smooth and responsive operation, and a color display with intuitive feedback. Various input devices can be used interchangeably to meet diverse needs. The system is highly programmable, and can be configured for different languages.

Figure 1. Wheelchair with the enAble® X1 System

Module List

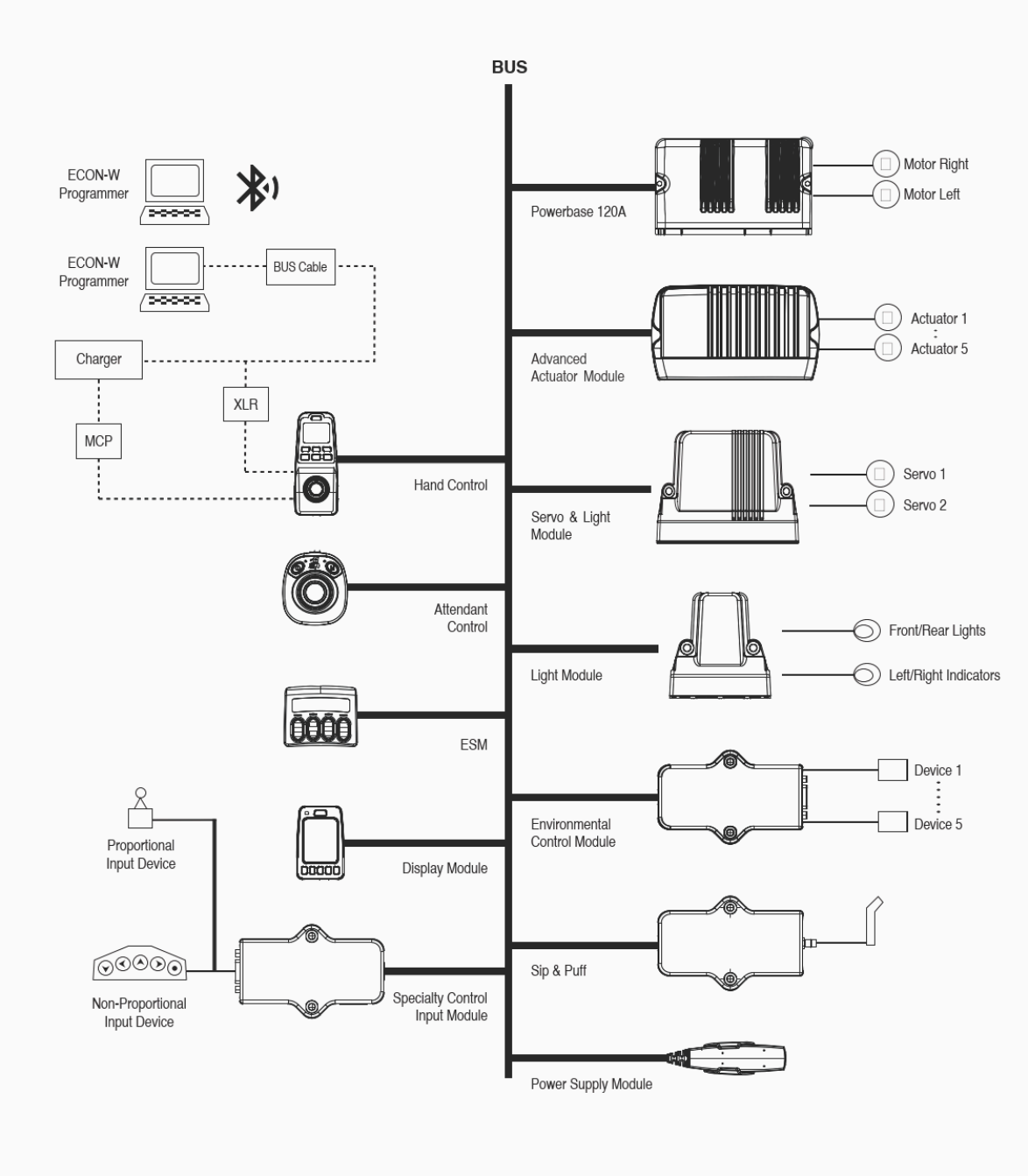
The following table lists the modules compatible within the enAble X1 system. Each module is described in the Modules section. At least two modules are necessary for the system to be operational: the Hand Control or Display Module (with the Specialty Control Input Module) and a Powerbase module.

Module Name	Module Abbreviation	Part Number
Hand Control Standard (XLR & MCP)	HCS-x1	17969700-2511
Hand Control Standard (MCP)	HCS-x1	17969700-2521
Hand Control Basic Drive only (XLR & MCP)	HCB-D-x1	17968700-4011
Hand Control Basic Drive & Actuators (XLR & MCP)	HCB-A-x1	17968700-4211
Hand Control Basic Drive Actuators and Lights (XLR & MCP)	HCB-AL-x1	17968700-4311
Display Module	DM-x1	17974700-1401
Attendant Control	AC-x1	17975700-2101
Specialty Control Input Module	SCIM-x1	17950700-1001
Sip & Puff Module	SPM-x1	17961700-0001
Powerbase 120A, Expandable	PB120-x1	17930700-3501
Powerbase 75A Drive Only	PB75-D-x1	17958700-1001
Powerbase 75A 2 Actuators	PB75-A2-x1	17958700-1201
Powerbase 90A Drive only	PB90-D-x1	17958700-2001
Powerbase 90A 2 Actuators	PB90-A2-x1	17958700-2201
Servo Steer Lighting Module	SLM-x1	17970700-9201
Advanced 5 Actuator Module	AAM5-x1	17952700-5001
3 Actuator / Light Module	AM3L-x1	17970700-5201
3 Actuator Module	AM3-x1	17970700-5001
Advanced 2 Actuator / Light Module	AAM2L-x1	17963700-2101
Light Module LED	LML-x1	17971700-0201
Enhanced Switch Module, Flat	ESM8-F-x1	17966700-4001
Enhanced Switch Module, Toggle	ESM8-T-x1	17966700-4101
Environmental Control Module	ECM5-x1	17956700-0201
Power Supply Module, includes the holster	PSM-x1	17951700-02-1101

Configuration Options

The enAble X1 modules work together over a CANopen-based bus system running a proprietary CAN protocol.

Figure 2.enAble X1 Block Diagram



The XLR port on the Hand Control and the Charger / Programming Harness is used for charging and programming. The 14-pin Molex connection on the Powerbase PB120 offers on-board charging, motor encoder feedback, and programmable switches.

The system can be programmed using the ECON application. See the Programmers appendix.

Compatibility Chart

The enAble X1 modules that can be connected to the system have defined compatibilities with other modules on the system. In general, primary modules are not compatible with each other, with the exception that the Display Module (DM) can be used with other primary modules on the system. Also, only one of each module type can be connected onto a configured system (e.g., AAM5 and AM3L is an acceptable combination, but AAM5 with AAM5 is not).

The chart below details which modules are compatible with the various primary modules. *Y* indicates compatibility, *N* indicates incompatibility, and *ND* indicates incompatibility because the modules are of the same type.

Table 1. Compatibility Chart

Modules		**Primary Module**				
Module Abbreviation	**Model Number**	**HCB-D-x1**	**HCB-A-x1**	**HCB-AL-x1**	**HCS-x1**	**DM-x1**
HCB-D-x1	1761-40x1	ND	N	N	N	**Y**
HCB-A-x1	1761-42x1	N	ND	N	N	**Y**
HCB-AL-x1	1761-43x1	N	N	ND	N	**Y**
HCS-x1	1761-25x1	N	N	N	ND	**Y**
DM-x1	1763-x401	N	N	N	**Y**	ND
AC-x1	1762-2101	**Y**	**Y**	**Y**	**Y**	**Y**
PB75-D-x1	1760-1001	**Y**	**Y**	**Y**	**Y**	**Y**
PB75-A2-x1	1760-1201	N	**Y**	**Y**	**Y**	**Y**
PB90-D-x1	1760-2001	**Y**	**Y**	**Y**	**Y**	**Y**
PB90-A2-x1	1760-2201	N	**Y**	**Y**	**Y**	**Y**
PB120-D-x1	1760-3501	**Y**	**Y**	**Y**	**Y**	**Y**
LML-x1	1765-0201	N	N	**Y**	**Y**	**Y**
AM3-x1	1765-5001	N	**Y**	**Y**	**Y**	**Y**
AM3L-x1	1765-5201	N	**Y**	**Y**	**Y**	**Y**
SM2L-x1	1765-9201	N	N	N	**Y**	**Y**
AAM2L-x1	1765-2101	N	**Y**	**Y**	**Y**	**Y**
AAM5-x1	1764-5001	N	**Y**	**Y**	**Y**	**Y**
SPM-x1	1767-0001	N	N	N	N	**Y**

Table 1. Compatibility Chart (continued)

Modules		Primary Module				
Module Abbreviation	**Model Number**	**HCB-D-x1**	**HCB-A-x1**	**HCB-AL-x1**	**HCS-x1**	**DM-x1**
SCIM-x1	1767-1001	N	N	N	N	**Y**
ECM5-x1	1766-0201	N	N	N	Y[1]	**Y**
ESM8-F-x1	1768-4001	N	N	N	**Y**	**Y**
ESM8-T-x1	1768-4101	N	N	N	**Y**	**Y**

The primary module defines the compatibility. The following list describes the compatibility rules for a system.

- Only one Powerbase is allowed.
- Only one Hand Control is allowed.
- Only one Enhanced Switch Module is allowed.
- Only one module that contains light drivers is allowed.
- Two identical modules are not allowed.

Using this Manual

This manual — the *enAble X1 Technical Manual* — is intended for OEM engineers that develop enAble® X1 applications. The manual describes how to configure and program enAble X1 systems.

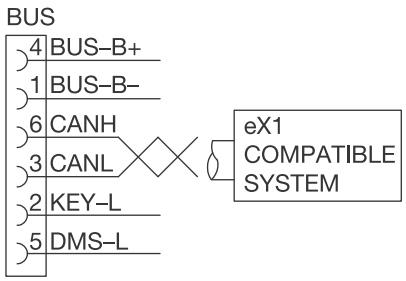
Developers should also read the *enAble X1 User Manual*. That manual is intended for end users and describes the system's features and operation.

1. ECM functions are available only via the ESM or MIO switches.

3 — Modules

All enAble X1 modules are connected by a 6-pin bus cable. A compatible module can be added or removed to the system while the system is powered off, and will be recognized at the next power on.

Figure 3. Bus Connector



The following table describes the bus current specifications.

Table 2. Bus Current Specifications

Specification	Value
Continuous current	13A
1 minute duration	15A
5 second duration	20A

The following figures describe other common connections that pertain to some of the modules.

Figure 4. XLR port (Hand Control, Charger / Programmer Harness)

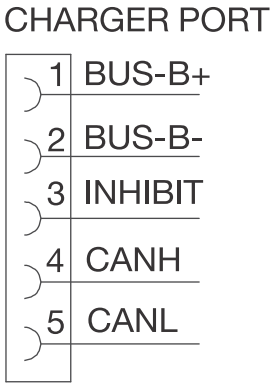


Figure 5. 9-Pin D-Sub Connections

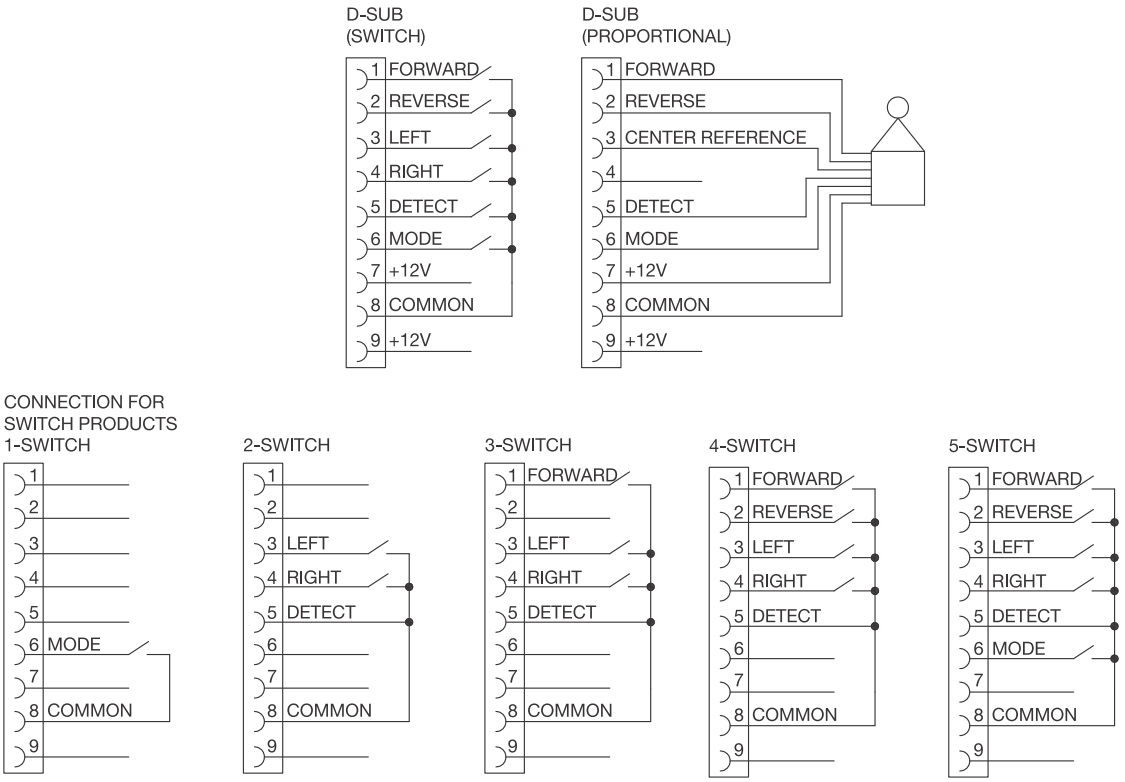


Figure 6. Stereo Jack Connections (Hand Control, Display Module, Attendant Control)

Note:

All dimensions shown in the following sections are for reference only.

Input Devices

The enAble X1 system has multiple input devices. The standard input device is the Hand Control Standard, but it is also possible to use the Display Module and Specialty Control Input Module (SCIM) to utilize a third party input device. There is also an Attendant Control that is intended for walk-behind use when the system is mounted to a wheelchair.

Hand Control Standard (HCS)

The Hand Control Standard (HCS) is used to drive the chair and control the seat. The Hand Control Standard also provides features such as adjusting settings, charging devices, and charging the chair's batteries.

Note:

If the system includes both the Hand Control Standard and the Display Module, the Display Module's screen displays information and the Hand Control Standard's screen displays the manufacturer's logo.

The following image shows the front of the Hand Control Standard:

The following table describes these items:

Number	Item
1	On/Off button
2	LCD Screen
3	Joystick

Number	Item
4	Soft Key buttons
5	Page button
6	Mode button
7	Horn button

WARNING:

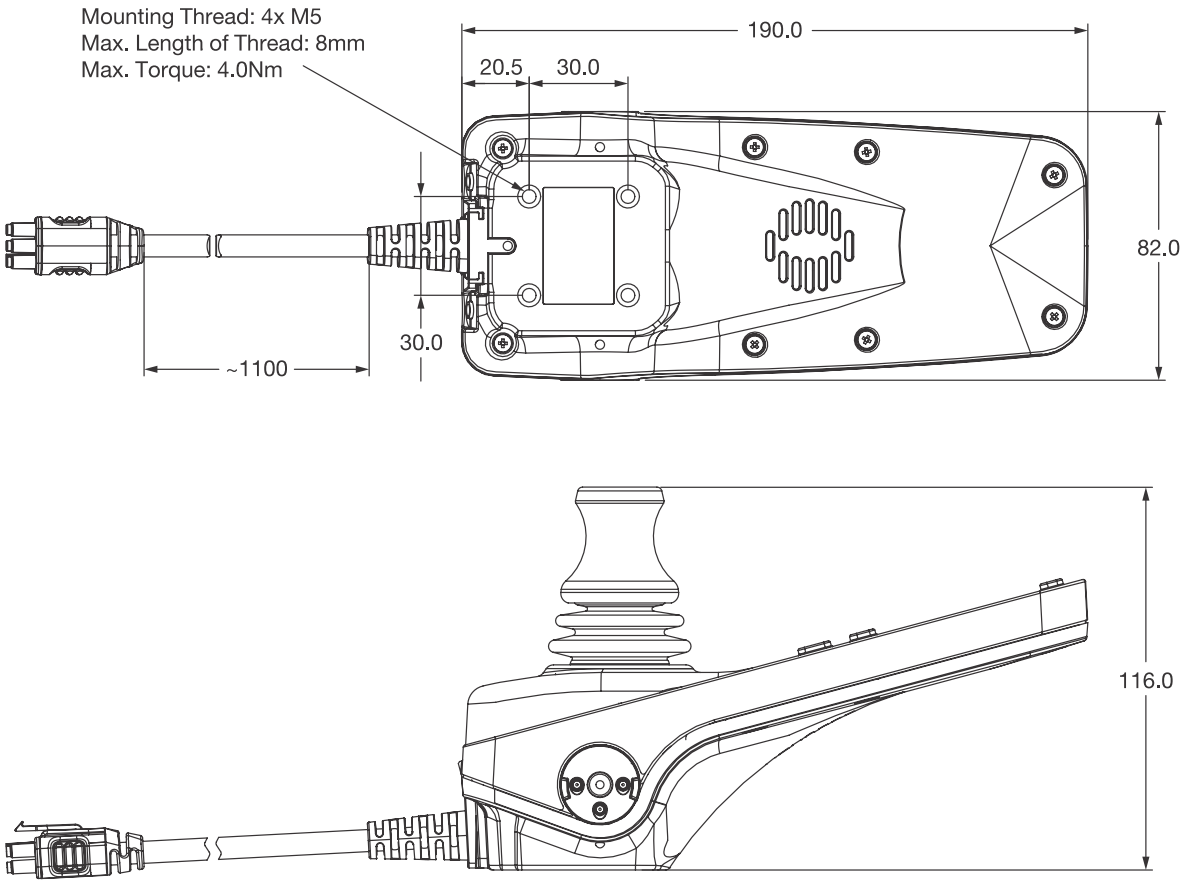
See Powering On/Off for important information regarding limitations if an Attendant Control is part of the system.

For more information on Hand Control Standard operation and features, see the *enAble X1 User Guide*.

HCS Mounting Diagram

Figure 7 describes the mounting dimensions of the Hand Control Standard.

Figure 7. Hand Control Standard Outline and Mounting



HCS Wiring Diagrams

Figure 8 shows the HCS connectors, and Figure 9 describes how to wire the connectors. Table 3 lists the mating connectors.

Figure 8. Hand Control Standard Connectors

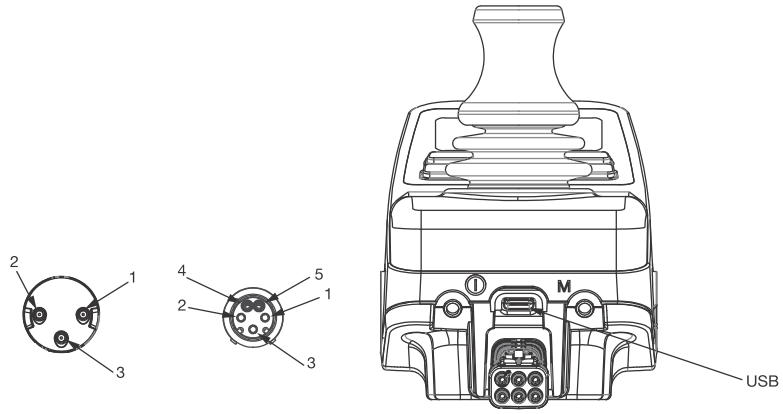


Figure 9. Hand Control Standard Wiring

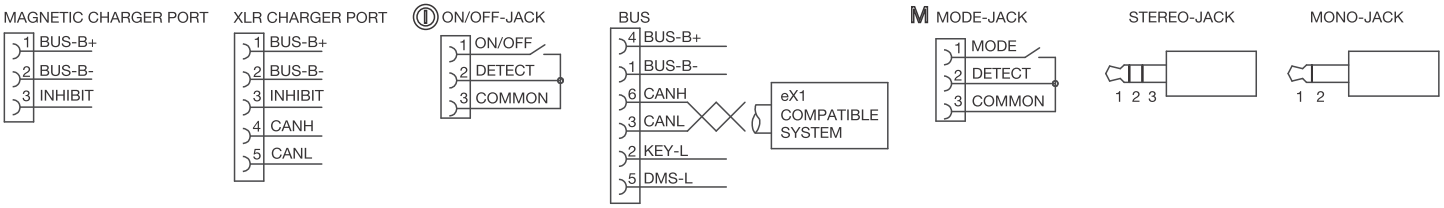


Table 3. Hand Control Standard Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
Magnetic Charger Port	Curtis MCC charger cable (part number 17969363)
XLR Charger Port	Either of the following: • 3-Pin XLR, male • Curtis programmer cable
On/Off and Mode Jacks	3.5mm jack, male
USB	USB Type-C plug

USB-C Connector

The bottom of the Hand Control Standard includes a USB-C connector for charging devices such as tablets and mobile phones:

The USB-C connector has the following electrical specifications:

Specification	Value
Nominal Voltage	5VDC
Nominal Current Output	3A

Jacks

The two stereo jacks on the bottom of the Hand Control Standard might be connected to inputs such as switches. If so, do not remove the inputs' plugs. The jacks can be assigned to different functions, but the typical usages are described in the following list:

- Left jack: On/Off switch.
- Right jack: Mode switch.

Each stereo jack supports up to two switches. The jacks are configurable by programming. The jack command options are Mode, Mode Shortcut, Home, Inactive, and Enter Lock. The On/Off jack also has an additional option for Power Off. The mapped I/O options are expansive; the best way to evaluate the options is with an ECON programmer. For information on the available options, see Jack Command.

Charging Port

WARNING:

See Warnings and Safety Instructions.

The right side of the Hand Control Standard includes a charging port. The charging port depends upon the model.

- Some models provide a five-pin XLR port. The XLR port can also be used to connect a Curtis Instruments programming device:

- Other models provide a three-pin port for magnetic chargers:

Important:

Keep the contacts on the magnetic charger port and on the associated magnetic charger connector clean and free from any debris that may affect the charging of the wheelchair. Contacts should be wiped clean with a dry duster on a regular basis.

The charger should match the battery's type, voltage, and capacity. Follow the charger manufacturer's instructions for choosing the correct charger and for proper operation, maintenance, and cleaning.

WARNING:

Using an unsuitable charger can cause permanent damage to all of the chair's components.

You cannot drive the chair when it is being charged.

Bluetooth Features

The Hand Control Standard uses Bluetooth to provide the following features:

- Pair the HCS with a device that has a Curtis programmer installed.
- Use the HCS as a mouse or gaming joystick.
- Use the HCS as iOS Assistive Switch Control.

For configuration information, see Bluetooth Capabilities. For information on using these features, see the Hand Control Standard section of the *enAble X1 User Manual*.

Hand Control Standard Parameters

The system provides numerous programmable parameters; see Hand Control Standard Parameters. The following list describes a few of the programming options:

- The default joystick configuration is a proportional input, but the joystick also be configured to switched input. For information on the various joystick configurations, see Input Configuration.
- The *speed adjust* feature is a Soft Key option that adjusts speed based on drive profile settings. A visual indication is displayed in the drive profiles by means of an incremental block highlighted within the Drive Profile arc. There are two display indication types for the user adjustable speed range, which is determined by the SPEED DIAL TYPE parameter.

Hand Control Basic (HCB)

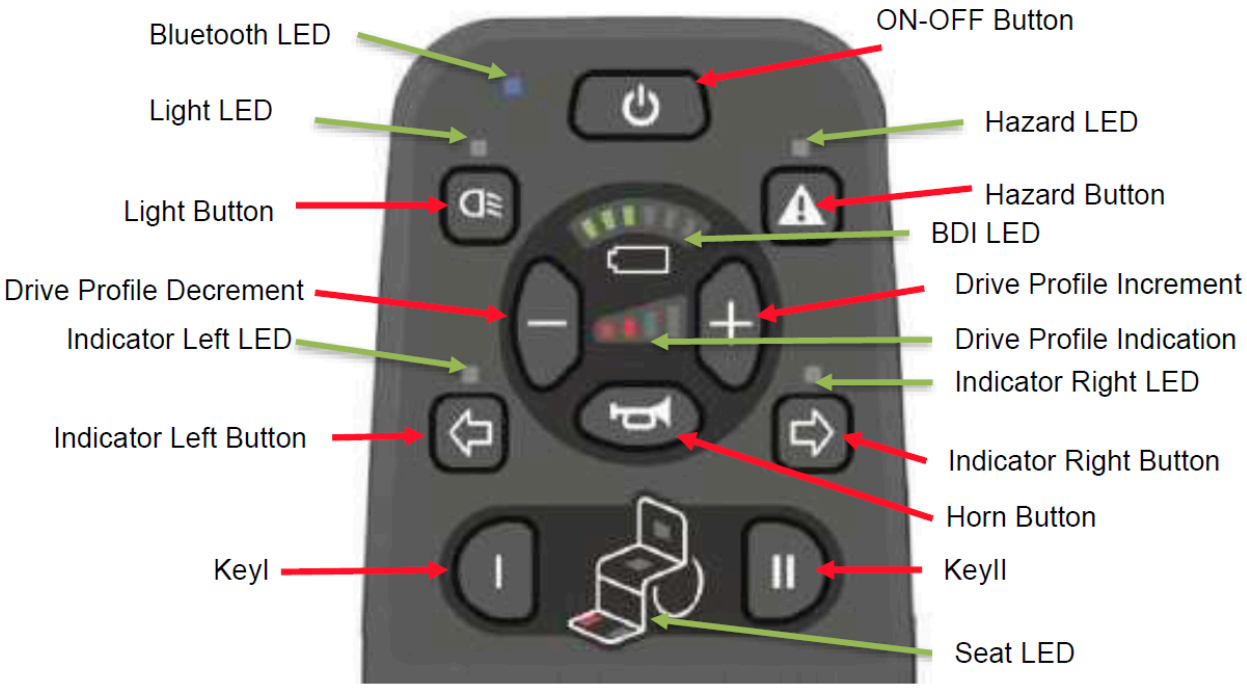
The Hand Control Basic (HCB) is a primary input device for the enAble X1 system. There are three HCB variants:

- Drive Only
- Drive plus Actuators
- Drive, Actuators and Lights

The HCB provides easy-to-use controls and LED feedback. The LEDs display information such as profile indication and battery state-of-charge. Some variants provide seating indication and lighting indication.

The Attendant Control (AC) and the Display Module can be used in systems that include the HCB.

The following image shows the controls and LEDs on the Hand Control Basic:



WARNING:

See Powering On/Off for important information regarding limitations if an Attendant Control is part of the system.

Note:

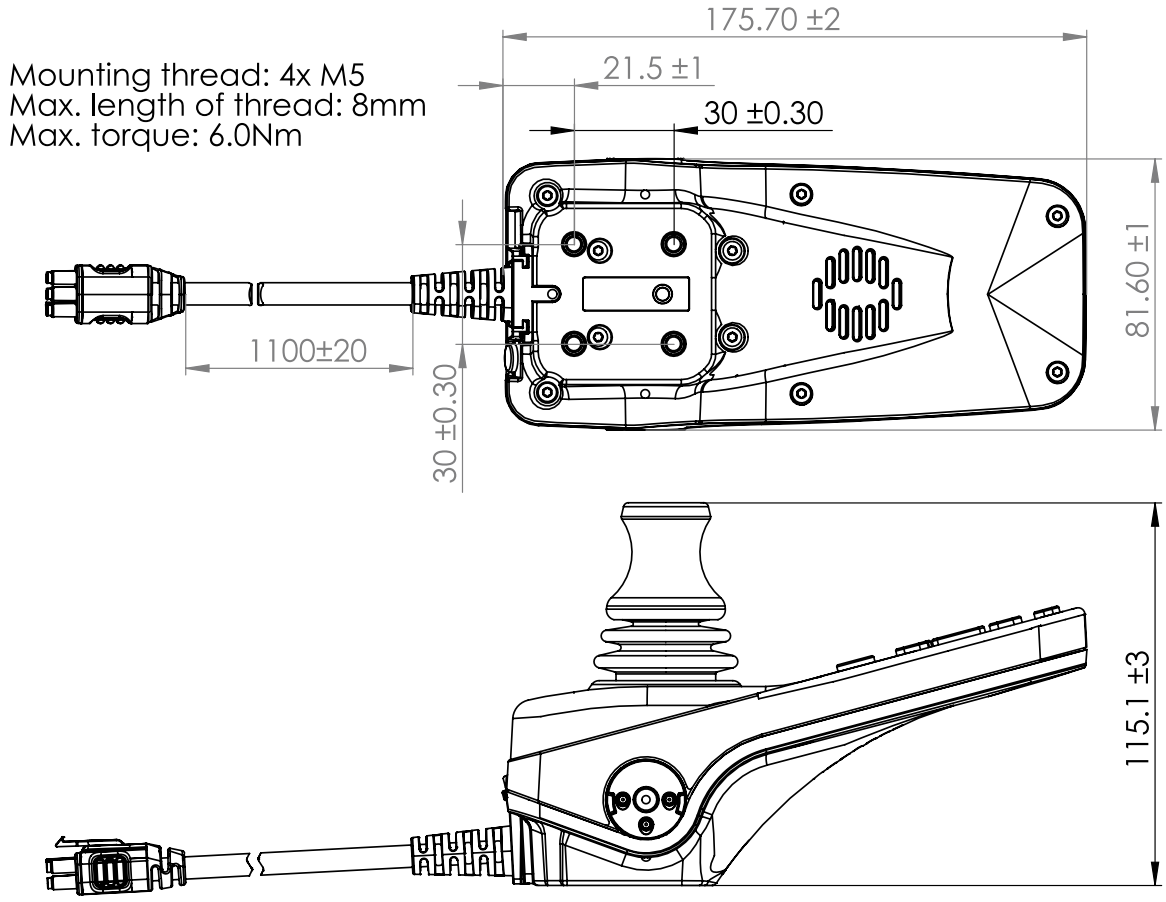
The HCB has internal memory, which is used to store the downloaded system firmware pack.

For more information on Hand Control Basic operation and features, see the *enAble X1 User Guide*.

HCB Mounting Diagram

Figure 10 describes the mounting dimensions of the Hand Control Basic.

Figure 10. Hand Control Basic Outline and Mounting



HCB Wiring Diagram

Figure 11 describes how to wire the Hand Control Basic. Table 4 lists the mating connectors.

Figure 11. Hand Control Basic Wiring

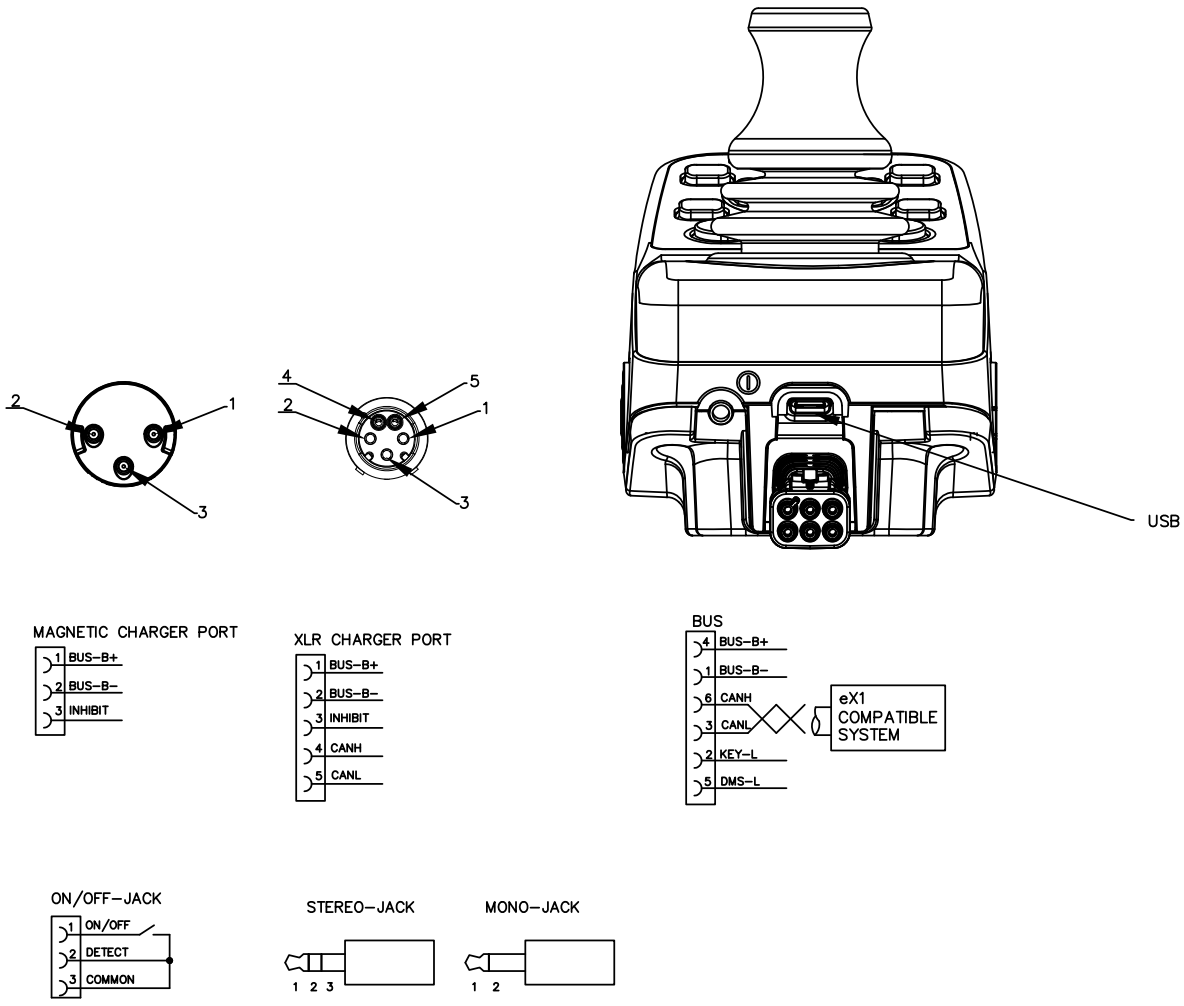


Table 4. Hand Control Basic Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
Magnetic Charger Port	Curtis MCC charger cable (part number 17969363)
XLR Charger Port	Either of the following: • 3-Pin XLR, male • Curtis programmer cable
Jack	3.5mm jack, male
USB	USB Type-C plug

Push Buttons

The HCB provides the following push buttons:

Button	Description
Key I	Programmable button for various operations.
Key II	Programmable button for various operations.
• + (Drive Profile Increment) • – (Drive Profile Decrement)	The + and – buttons change the active drive profile to the next profile.
Horn	Sounds an adjustable audio alert.

HCB models with lights also provide buttons for lights, left and right turns, and hazards.

Note:

For information on adjustments, see Audio: Horn Menu.

Charger Ports

The HCB provides two ports that can be used for charging:

- A five-pin XLR port. The XLR port can also be used to connect a Curtis Instruments programming device.
- A three-pin port for magnetic chargers.

Note:

The magnetic charger port cannot be used to connect a programming device.

Important:

Keep the contacts on the magnetic charger port and on the associated magnetic charger connector clean and free from any debris that may affect the charging of the wheelchair. Contacts should be wiped clean with a dry duster on a regular basis.

Jack

The stereo jack supports up to two switches. The jack is configurable by programming. The jack command options are Mode Select, Power Off, Inactive, and System Lock. The mapped I/O options are expansive; the best way to evaluate the options is with an ECON programmer.

For information on the available options, see Jack Command.

Ambient Light Sensor

The ambient light sensor determines the display brightness using two possible settings, day or night. Both brightness levels are programmable.

For adjustment parameters, see Display: Brightness Menu.

USB-C Connector

The HCB includes a USB-C connector that can be used to charge devices such as smart phones and tablets. The connector has the following electrical specifications:

Specification	Value
Nominal Voltage	5VDC
Nominal Current Output	3A

Mode Select Command

The mode select command cycles through the HCB drive profiles and seat profile. There are multiple ways to generate a mode select command:

- Key I or Key II.

  Note:

  These keys are mapped to mode commands that cycle through drive and seat profiles. To remap, use the KEY I and KEY II parameters. See HCB: Button Operation Menu.

- A DEVICE DOUBLE COMMAND on the input device.
- Mapped I/O.

In the following example, a mode select command navigates to a drive profile. Successive mode commands then navigate to seat, then back to drive, etc.

	Mode 1	Mode 2
Mode Command	Drive	Seat

Drive Profile Selection

The enAble X1 system allows individual drive profiles to be disabled, thus reducing the number of profiles available to the user. To disable drive profiles, use the parameters in the HCB: Profile Setup Menu.

In the following example, drive profiles 3 and 4 are disabled. Successive commands on the + and – buttons cycle between drive profile 1 and drive profile 2 only.

	Profile 1	Profile 2	Profile 3	Profile 4
Drive Mode	Drive 1	Drive 2	Disabled	Disabled

WARNING:

When accessing drive profiles after the system has powered up, the first configured drive profile in Profile Setup may not be the slowest drive profile. Also, all drive profiles can be configured at any speed, so the first drive profile may not be the slowest even if it is denoted as Drive Profile 1.

Profile Change Stop

You can configure the system so that operators can change the drive profile while driving. The PROFILE CHANGE STOP DRIVE parameter on the Profile Change Stop menu enables or disables this feature:

- If the PROFILE CHANGE STOP DRIVE parameter is enabled, pressing the + or – button always stops driving before the mode command is executed.
- If PROFILE CHANGE STOP DRIVE is disabled and the next profile is a drive profile, pressing the + or – button changes to the next drive profile without stopping the chair.

Bluetooth Features

The Hand Control Basic uses Bluetooth to provide the following features:

- Pair the HCB with a device that has a Curtis programmer installed.
- Use Interactive Assist.

For steps on pairing, see the Hand Control Basic section of the *enAble X1 User Manual*.

Display Module (DM)

The Display Module (DM) can be used for a variety of specialty input devices in conjunction with the Specialty Control Input Module (SCIM) via the 9-pin D-sub connection in the SCIM. The Display Module has a larger LCD than the Hand Control Standard. The display information is the same as that shown on the Hand Control. If the Display Module is not used with a Hand Control, the horn is accessible through the auxiliary menu or via mapped I/O.

You cannot use the Display Module to drive the chair. Driving requires another input, such as the Hand Control Standard, Specialty Control Input Module (SCIM), or Sip & Puff Module (SPM).

Note:

If the system includes both the Hand Control Standard and the Display Module, the Display Module's screen displays information and the Hand Control Standard's screen displays the manufacturer's logo.

The following image shows the front of the Display Module:

The following table describes the items marked with callouts:

Number	Item
1	On/Off button
2	LCD screen
3	Keypad

WARNING:

See the Powering On/Off section for important information regarding limitations if an Attendant Control is part of the system.

For information on Display Module operation and features, see the *enAble X1 User Guide*.

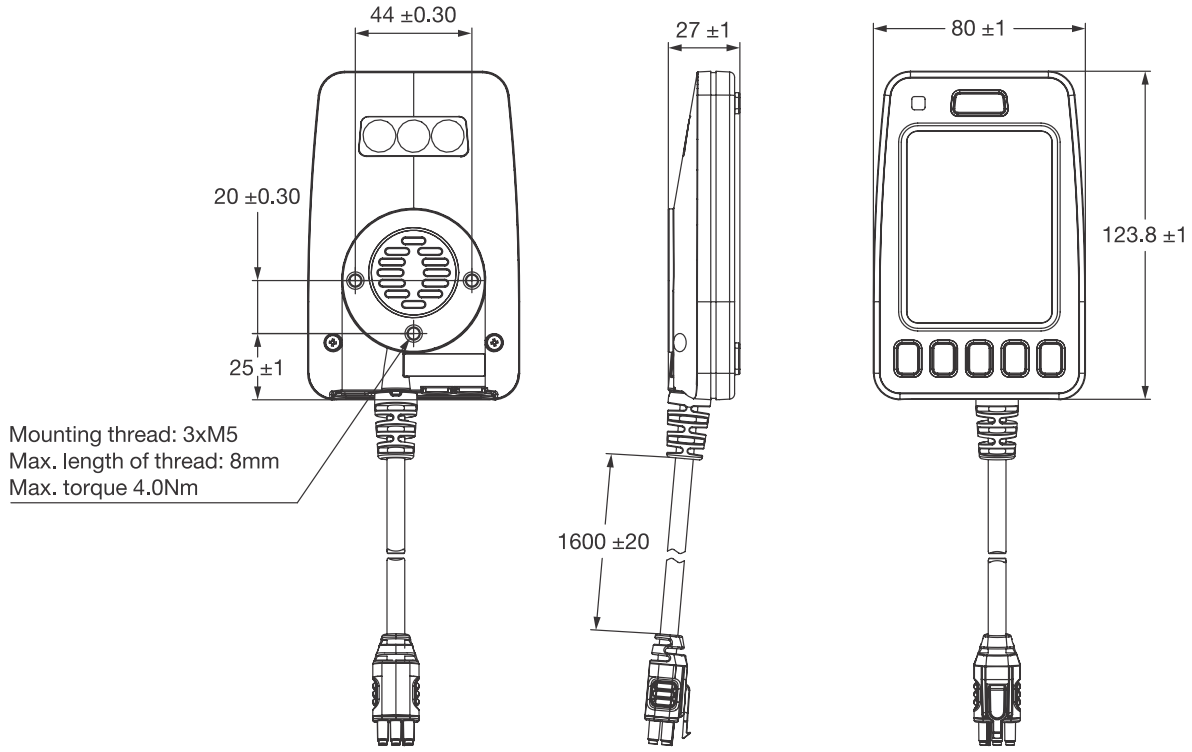
Related information

Display Module Parameters

DM Mounting Diagram

Figure 12 describes the mounting dimensions of the Display Module.

Figure 12. Display Module Outline and Mounting



DM Wiring Diagrams

Figure 13 shows the DM connectors, and Figure 14 describes how to wire the connectors. Table 5 lists the mating connectors.

Figure 13. Display Module Connectors

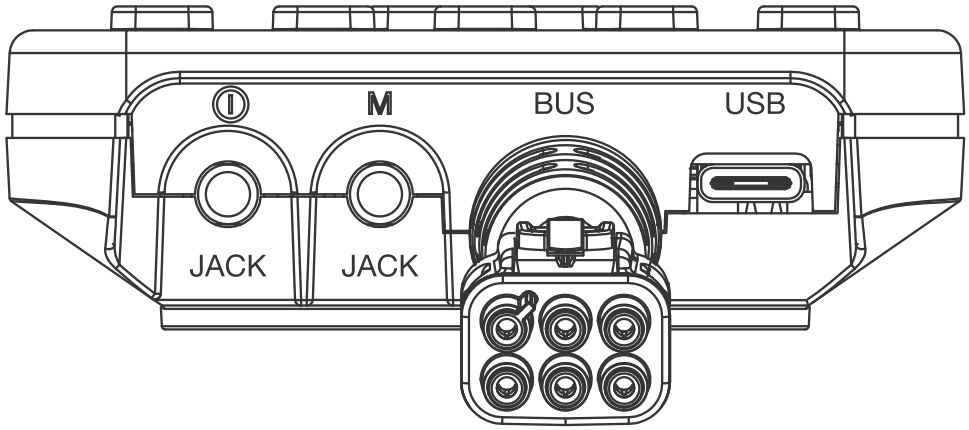


Figure 14. Display Module Wiring

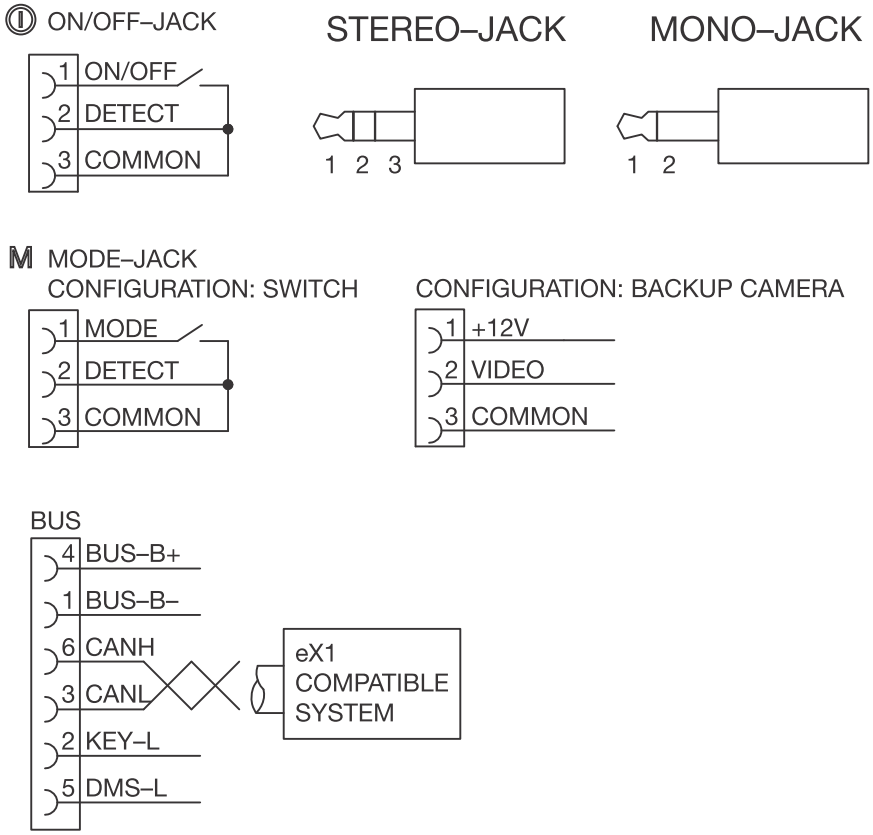


Table 5. Display Module Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
Jacks	3.5mm jack, male
USB	USB Type-C plug

USB-C Connector

The bottom of the Display Module includes a USB-C connector for charging a device such as a mobile phone:

The USB-C connector has the following electrical specifications:

Specification	Value
Nominal Voltage	5VDC
Nominal Current Output	3A

Jacks

The two stereo jacks on the Display Module might be connected to inputs such as switches. If so, do not remove the inputs' plugs.

Each stereo jack supports up to two switches. The jacks are configurable by programming. The jack command options are Mode, Mode Shortcut, Home, Inactive, and Enter Lock. The On/Off jack also has an additional option for Power Off. The mapped I/O options are expansive; the best way to evaluate the options is with an ECON programmer. For information on the available options, see Jack Command.

Bluetooth Features

The Display Module uses Bluetooth to provide the following features:

- Pair the DM with a device that has a Curtis programmer installed.
- Use the DM as a mouse or gaming joystick.
- Use the DM as iOS Assistive Switch Control.

For configuration information, see Bluetooth Capabilities. For information on using these features, see the Display Module section of the *enAble X1 User Manual*.

Attendant Control (AC)

The Attendant Control module (AC) enables an attendant to drive the chair while walking behind it. The attendant can also adjust the seat and adjust settings. When the Attendant Control is active, the Hand

Control Standard, Hand Control Basic (HCB), or Display Module displays information such as the active drive profile.

When the Attendant Control is the active input, the buttons on the Hand Control or Display Module cannot be used. The Hand Control's joystick also cannot be used.

The following image describes the controls on the front of the Attendant Control:

The following table describes these items.

Number	Item
1	On/Off button
2	Battery LED
3	Actuator LEDs
4	Drive Profile LED
5	Mode button
6	Joystick

WARNING:

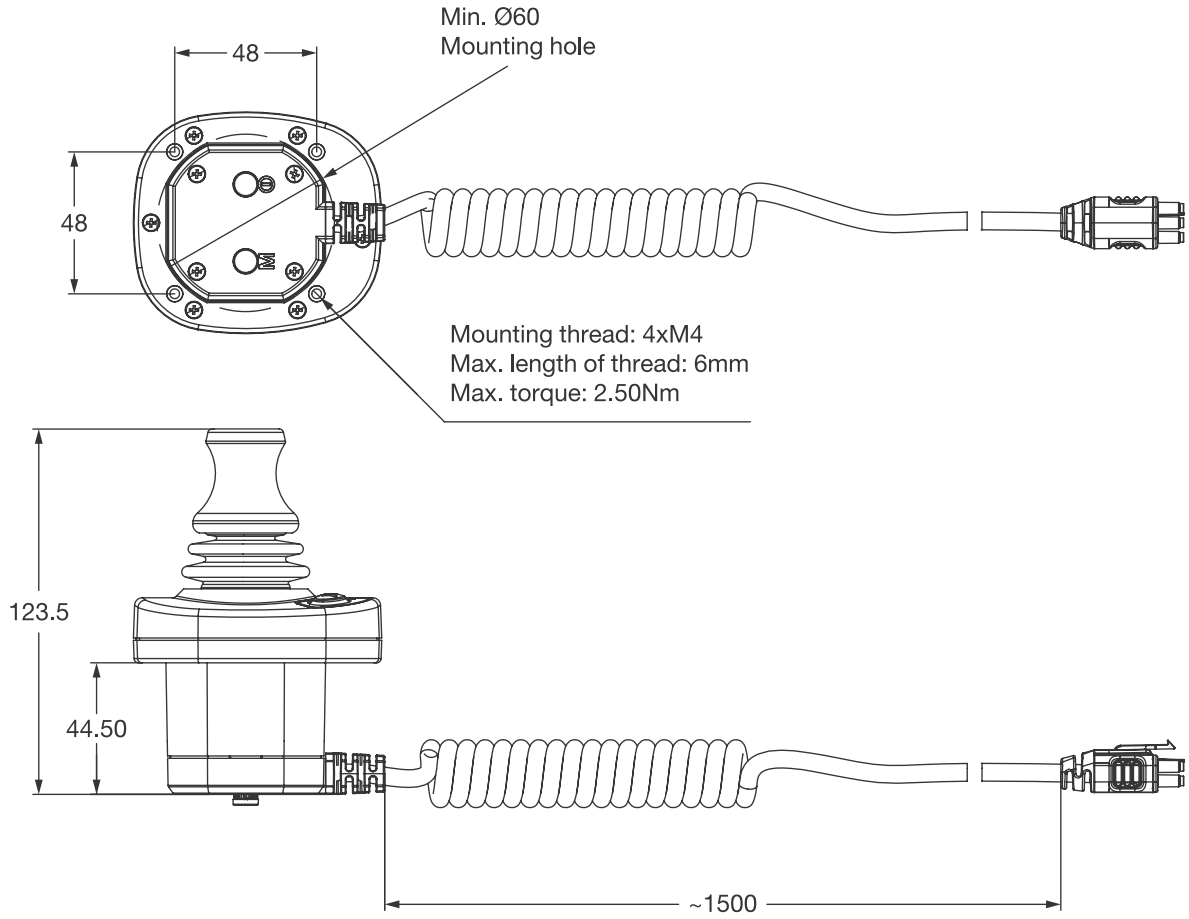
See the Powering On/Off section for important information regarding limitations if an Attendant Control is part of the system.

For information on Attendant Control operation and features, see the *enAble X1 User Guide*.

AC Mounting Diagram

Figure 15 describes the mounting dimensions of the Attendant Control.

Figure 15. Attendant Control Outline and Mounting



AC Wiring Diagrams

Figure 16 shows the AC connectors, and Figure 17 describes how to wire the connectors. Table 6 lists the mating connectors.

Figure 16. Attendant Control Connectors

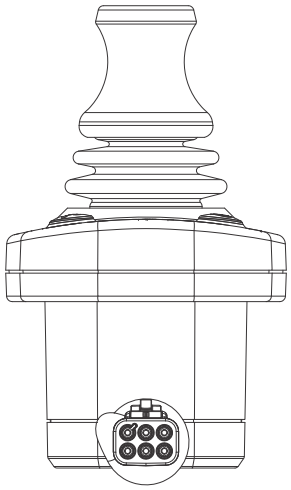


Figure 17. Attendant Control Wiring

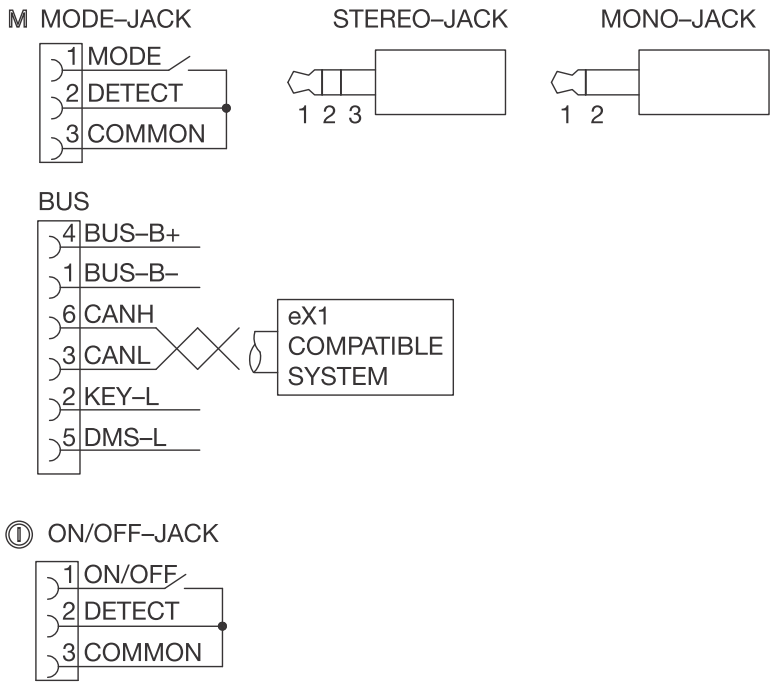


Table 6. Attendant Control Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
Jacks	3.5mm jack, male

Faults and the LEDs

If the Attendant Control is the active input device and a fault is active, the battery and drive profile LEDs flash eight times. The fault indicator is displayed on the screen of the Hand Control Standard or Display Module.

Note:

To view more details about a fault, use a programmer.

Jacks

The two jacks on the Attendant Control are not configurable and provide a mono audio format. The jacks are used for mode and power on/off commands only, and are labeled accordingly. Supervision applies to the on/off jack only.

Specialty Control Input Module (SCIM)

The Specialty Control Input Module (SCIM) is used for connecting a compatible third party input device. The SCIM is used to power the system on and off, execute a mode command, and navigate the system.

Figure 18. Specialty Control Input Module

9-Pin D-Sub

To operate the system using a specialty control, connect a compatible device to the SCIM's 9-pin connector. For information on proportional and switched configurations, see Figure 19.

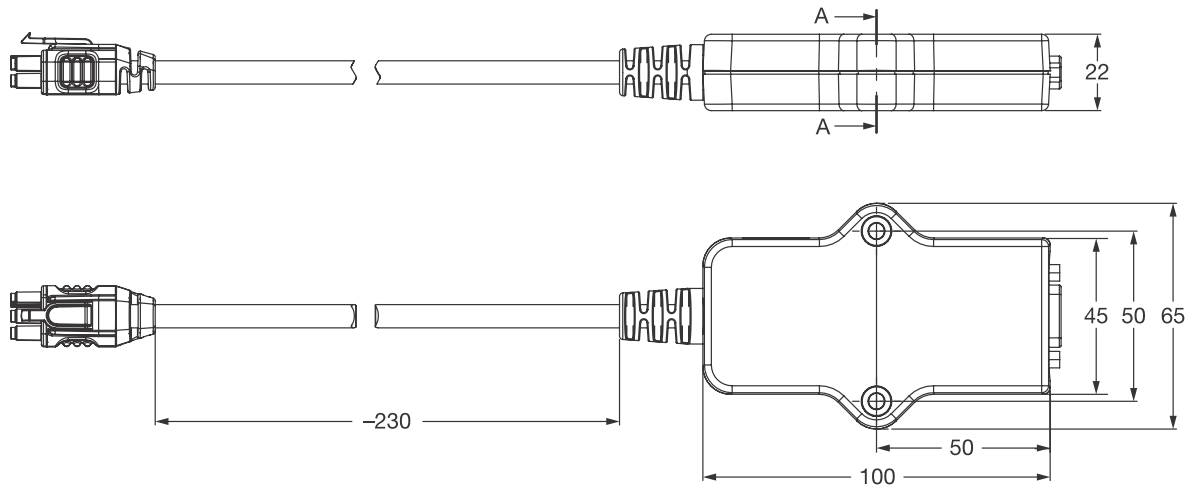
WARNING:

For input devices designed to work with the Specialty Control Input Module, the device manufacturer must ensure that the SID design is safe under all conditions. Specifically, single component failures must be detected and the input device put into a safe condition. Curtis Instruments accept no responsibility for losses of any kind resulting from an unsuitable SID design.

SCIM Mounting Diagram

Figure 19 describes the mounting dimensions of the SCIM.

Figure 19. SCIM Outline and Mounting



SCIM Wiring Diagrams

Figure 20 shows the SCIM connectors, and Figure 21 describes how to wire the connectors. Table 7 lists the mating connectors.

Figure 20. SCIM Connectors

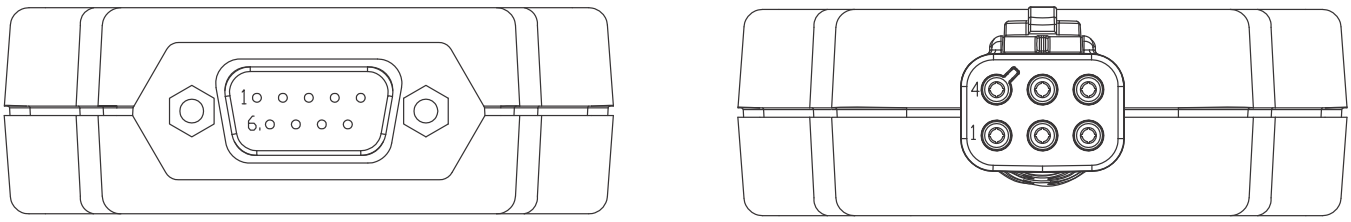


Figure 21. SCIM Wiring

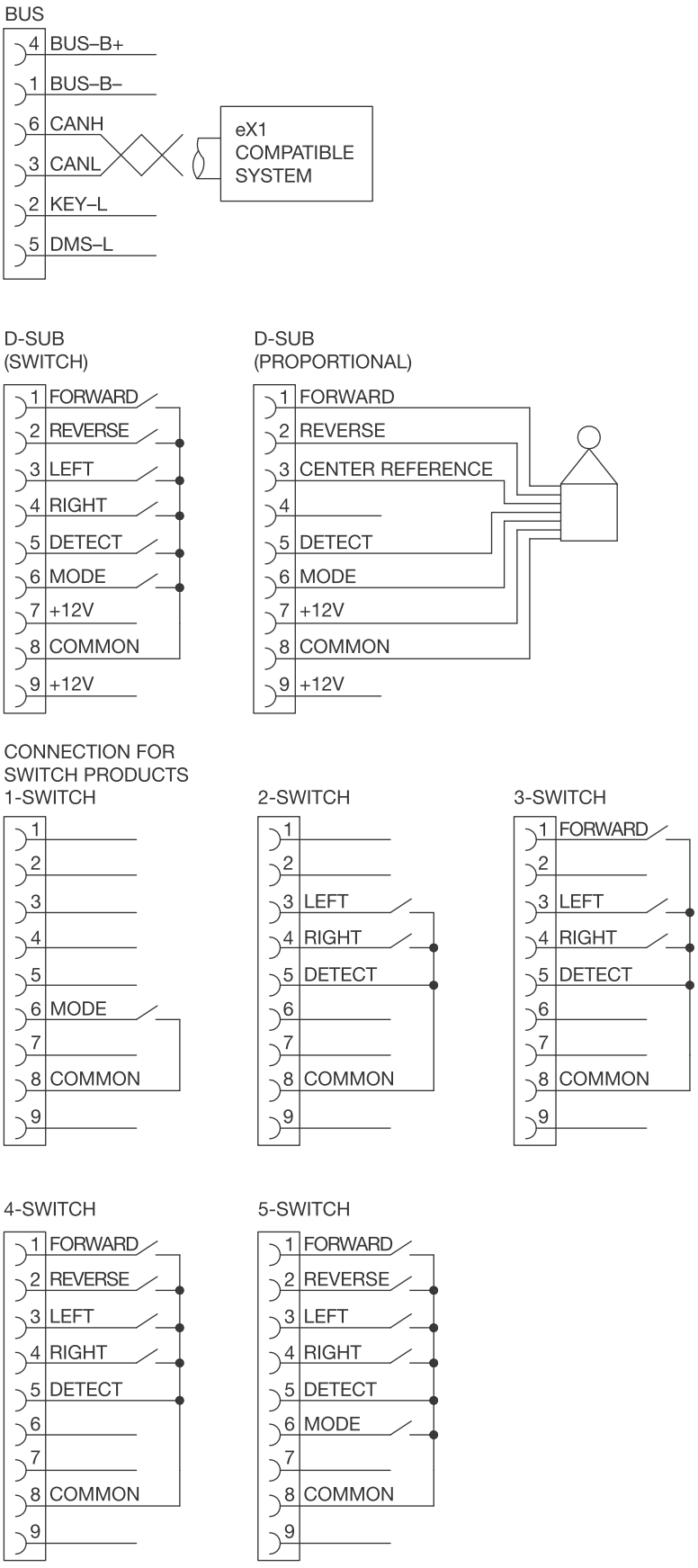


Table 7. SCIM Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
9-Pin D-Sub	DB9, female

Sip & Puff Module (SPM)

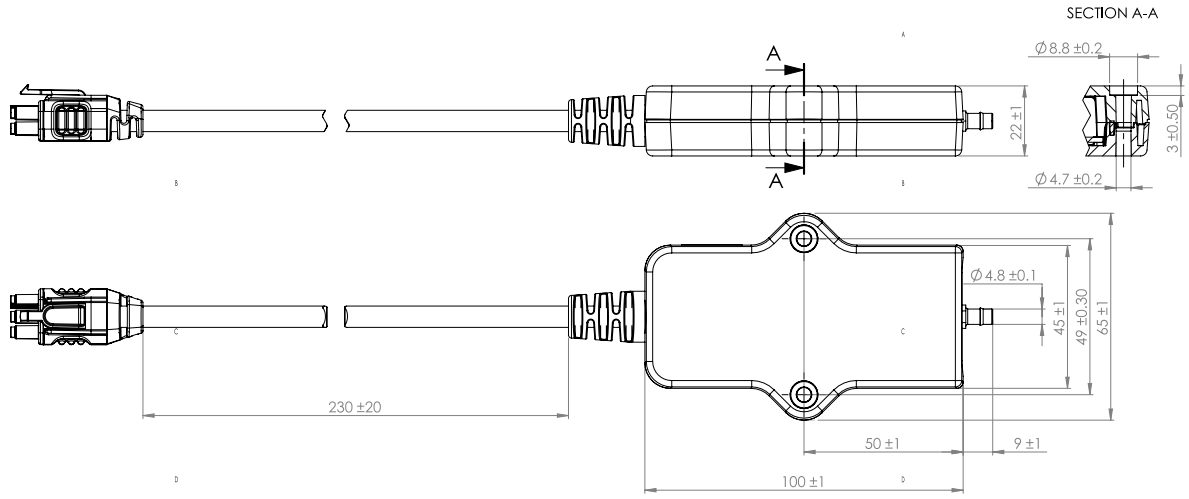
The Sip & Puff Module (SPM) is a breath-controlled input device that can be configured for two or four pressure inputs.

Figure 22. Sip & Puff Module

SPM Mounting Diagram

Figure 23 describes the mounting dimensions of the Sip & Puff Module.

Figure 23.SPM Outline and Mounting



SPM Wiring Diagrams

Figure 24 describes how to wire the Sip & Puff Module. Table 8 lists the mating connectors.

Figure 24.SPM Wiring

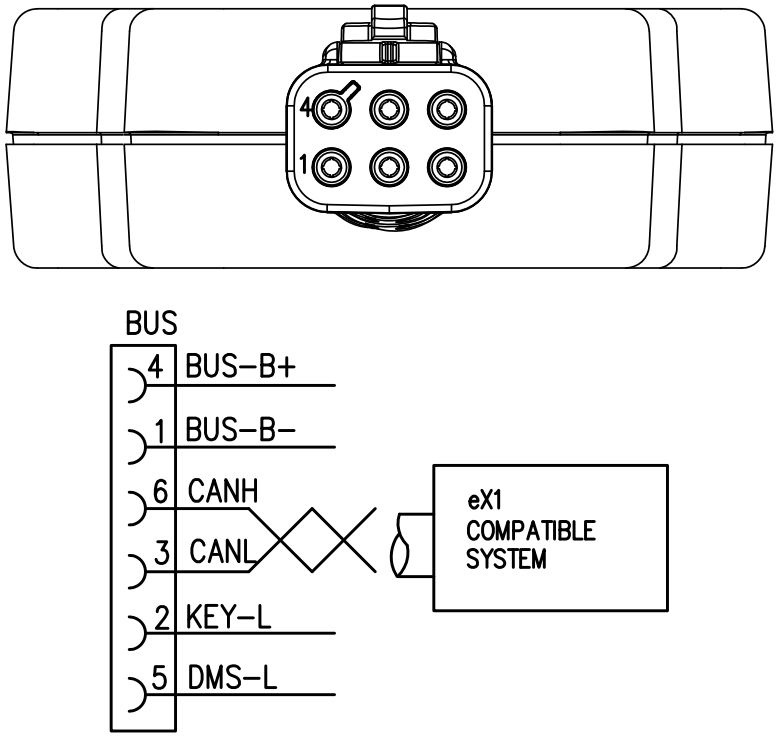


Table 8. SPM Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
Barbed Tube Connector	• Inner diameter: 3.18mm (1/8") • Outer diameter: 6.35mm (1/4") or similar

Powerbase Models

The following sections describe enAble X1 Powerbase models.

Powerbase 75A (PB75) and Powerbase 90A (PB90)

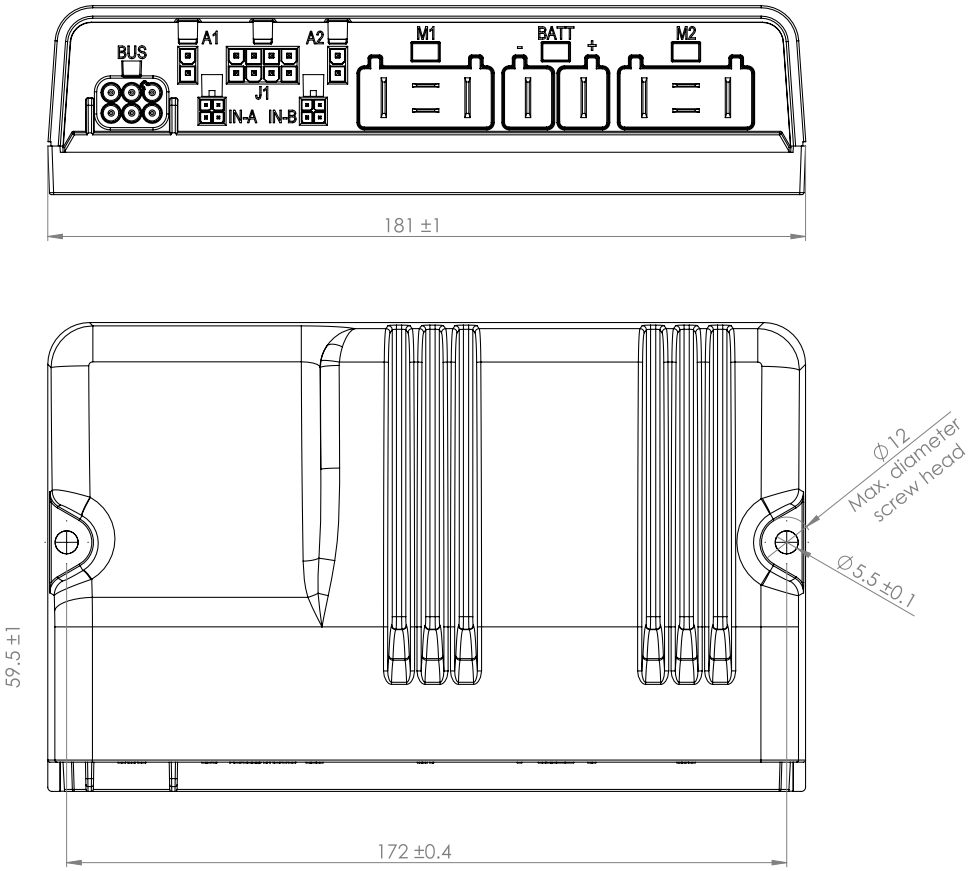
The Powerbase 75A (PB75) and the Powerbase 90A (PB90) are speed controllers with dual motor and brake output. The Powerbases are the main connection to the battery. Only permanent-magnet DC (PMDC) motors are supported. The Powerbase 75A and Powerbase 90A features include onboard charging, gyro stability control, and programmable switches (all optional to configure).

Figure 25. Powerbase 75A/90A

Powerbase 75A and 90A Mounting Diagram

Figure 26 describes the mounting dimensions of the PB75 and PB90.

Figure 26. PB75 and PB90 Outline and Mounting



Powerbase 75A and 90A Wiring Diagrams

Figure 27 shows the PB75 and PB90 connectors, and Figure 28 describes how to wire the connectors. Table 9 lists the mating connectors.

Figure 27. PB75 and PB90 Connectors

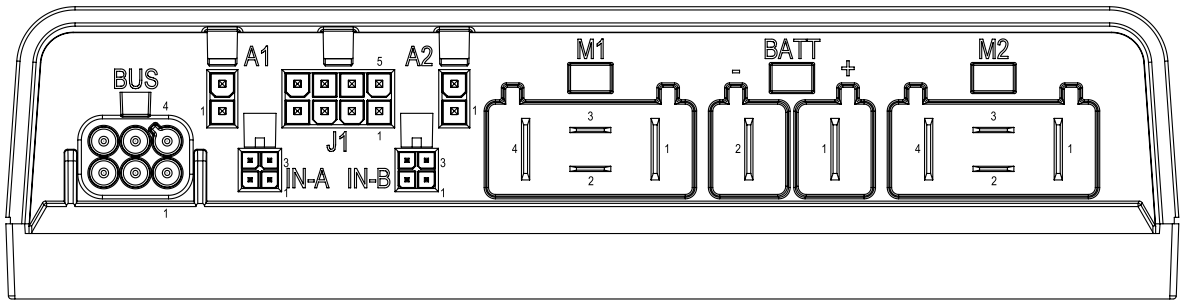


Figure 28. PB75 and PB90 Wiring

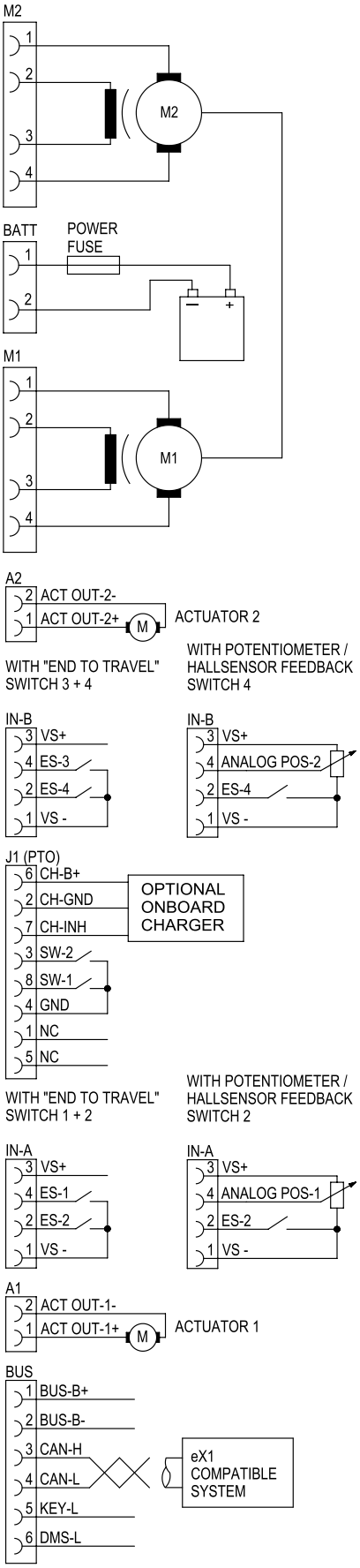


Table 9. PB75 and PB90 Mating Connectors

Part	Description	Crimp Contact
Bus	Curtis enAble X1 bus cable	*Not applicable*
A1, A2	2-pin Mini-Fit Jr. (e.g., 39-01-3028)	Mini-Fit female crimp terminal: • 9A Series 5556 • 12A Series 44476
J1 / PTO: (Light)	8-Pin Mini-Fit Jr. (e.g., 39-01-2085)	Mini-Fit female crimp terminal: • 9A Series 5556 • 12A Series 44476
IN-A, IN-B	4-Pin Micro-Fit (e.g., 43025-0400)	Mini-Fit female crimp terminal, Series 43030
BATT	Curtis battery connector (e.g., 37384)	Female crimp terminal, Maxi-Power timer contact (e.g., Curtis 12690FC34)
M1, M2	Curtis battery connector (e.g., Curtis 37383)	• Crimp female terminal MX-1, MX-4, Maxi-Power timer contact (e.g., Curtis 12690FC34) • Crimp female terminal MX-2, MX-3, Standard power timer contact (e.g., Curtis 12690FC35)

Motor Connection

MANDATORY:

For all motors, contact Curtis Instruments Inc. to obtain proper motor settings for safe operation.

Each Powerbase 75A/90A motor output operates up to 24V and 90A. The following tables describe the current ratings.

Table 10. Motor Output Current Rating (PB75)

Current	Time
75A	For 5 seconds
60A	For 1 minute
35A	Continuous

Table 11. Motor Output Current Rating (PB90)

Current	Time
90A	For 5 seconds

Table 11. Motor Output Current Rating (PB90) (continued)

Current	Time
60A	For 1 minute
35A	Continuous

The motor connections are protected against short circuit between the two motor connectors (M1 and M2). A short from the battery (B+/B–) to the motor connector may damage the controller. If the controller is damaged, it stops all motor output and signals a fault to the main display (Hand Control or Display Module).

The Powerbase 120A also features *Motor Current Foldback* and *Motor Stall Detection*. The following list describes the features and the relevant parameters on the Motor menu:

- Motor Current Foldback is a current reduction that occurs when the current exceeds MOTOR CURRENT FOLDBACK THRESHOLD on either channel for the period specified by MOTOR CURRENT LIMIT TIME.

  The current reduces to the current specified by MOTOR CURRENT FOLDBACK for the period specified by the MOTOR CURRENT LIMIT TIME.
- Motor Stall Detection ensures there is no motor output and the brakes engage when the current exceeds the MOTOR STALL CURRENT THRESHOLD for the period specified by MOTOR STALL TIME THRESHOLD and the speed is less than the speed specified with MOTOR STALL SPEED THRESHOLD.

Each brake output is PWM-controlled up to 24 VDC. Two voltages are available for configuration; the voltages are configured by the APPLY VOLTAGE and CONTINUOUS VOLTAGE parameters on the Brake Settings menu. APPLY VOLTAGE ensures the brakes release, and CONTINUOUS VOLTAGE ensures the brakes do not get re-engaged. The brake output voltage is consistent regardless of the battery voltage. The maximum continuous current rating for each brake output is 1.5A.

If either the motor or brake connection is disconnected or shorted, the system will not be operable and the corresponding faults will be raised. To clear the faults, the system must be powered down and the connections should be checked.

Battery Connection

The nominal voltage of the battery connection (B+/B−) is 24VDC. An internal relay is used to protect against polarity swap. See Battery Specifications.

Push Mode

A user can push the wheelchair by manually releasing the motor brake. If the brake lever is released while the system is on and a drive command is active, a fault will be raised. If a fault is raised, the user must manually engage the brake and power cycle the system.

If the brake lever is released while the system is off, the user should manually engage the brake before powering on. Otherwise, the system will boot up with a corresponding brake fault.

Gyro Stability Control

The Powerbase includes Gyro Stability Control options. This enables a high degree of control while the wheelchair is turning, and also allows better straight-line tracking over obstacles and on uneven terrain. Gyro technology works by maintaining the desired drive direction irrespective of the external forces acting on the wheelchair.

High-speed, front-wheel-drive type wheelchairs gain the most benefit from the addition of a gyro. However, the technology will also offer vastly improved drive performance on mid-wheel-drive and rear-wheel-drive models when they are used with switch-type specialty controls.

The Gyro system in the Powerbase is self-calibrating, so no additional calibration work is required in the field when the Gyro function is enabled.

Onboard Charging

The Powerbase supports connecting an onboard charger through the J2 or J6 Molex connector. If the charger is actively charging, the system will drive the Inhibit Line (Pin 9) high or low to prevent driving. Depending on the charger, the CHARGER INHIBIT parameter on the Charger menu must be set accordingly (high active or low active).

Switch Inputs

There are two switch inputs on the J2 Molex connection. The switches are programmable for a variety of functions. For information on all options, see Mapped I/O.

Powerbase 120A (PB120)

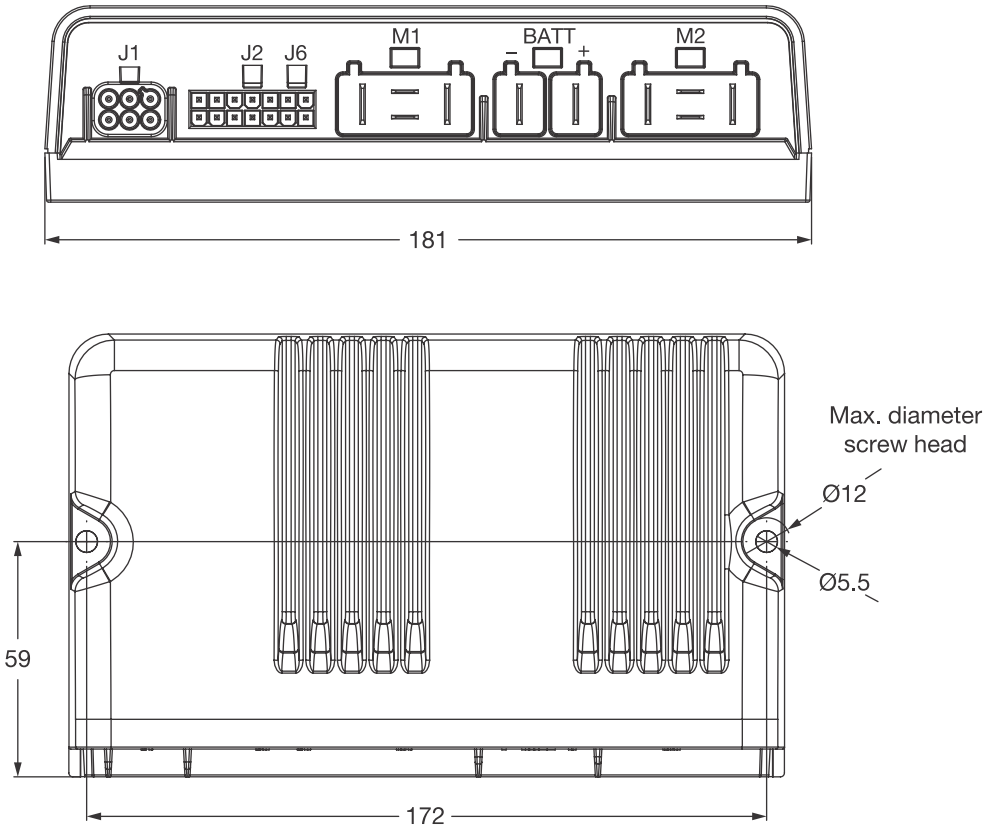
The Powerbase 120A (PB120) is a speed controller with dual motor and brake output, and is the main connection to the battery. Only permanent-magnet DC (PMDC) motors are supported. The Powerbase 120A features include quadrature encoder feedback for each motor, onboard charging, and programmable switches (all optional to configure).

Figure 29. Powerbase 120A

Powerbase 120A Mounting Diagram

Figure 30 describes the mounting dimensions of the Powerbase 120A.

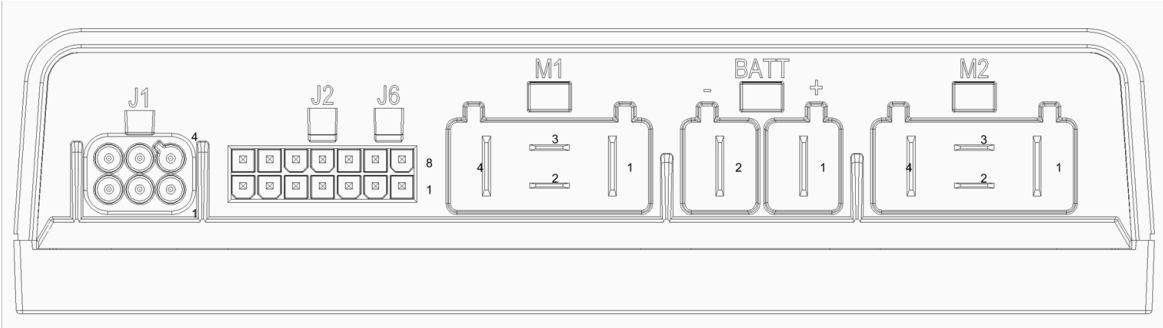
Figure 30. PB120 Outline and Mounting



Powerbase 120A Wiring

Figure 31 describes how to wire the Powerbase 120A. Table 12 lists the mating connectors.

Figure 31. PB120 Wiring



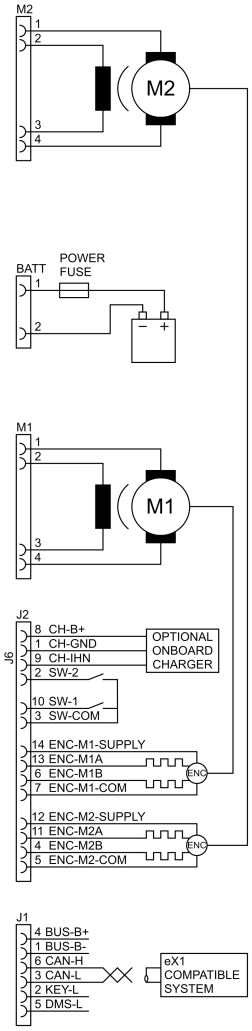


Table 12. Mating Connectors

Part	Description	Crimp Contact
Bus	Curtis enAble X1 bus cable	*Not applicable*

Table 12. Mating Connectors (continued)

Part	Description	Crimp Contact
J2	14-Pin Mini-Fit Jr. (e.g., 39-01-2145)	Mini-Fit female crimp terminal: • 9A Series 5556 • 12A Series 44476
J6	4-Pin Mini-Fit Jr. (e.g., 39-01-3048)	Mini-Fit female crimp terminal: • 9A Series 5556 • 12A Series 44476
BATT	Curtis battery connector (e.g., 37384)	Female crimp terminal, Maxi-Power timer contact (e.g., Curtis 12690FC34)
M1, M2	Curtis battery connector (e.g., 37383)	• Crimp female terminal MX-1, MX-4, Maxi-Power timer contact (e.g., Curtis 12690FC34) • Crimp female terminal MX-2, MX-3, Standard power timer contact (e.g., Curtis 12690FC35)

Motor Connection

MANDATORY:

For all motors, contact Curtis Instruments Inc. to obtain proper motor settings for safe operation.

Each Powerbase 120A motor output operates up to 24V and 120A. The following table describes the current ratings.

Table 13. Motor Output Current Rating (PB120)

Current	Time
120A	For 5 seconds
60A	For 1 minute
35A	Continuous

The motor connections are protected against short circuit between the two motor connectors (M1 and M2). A short from the battery (B+/B–) to the motor connector may damage the controller. If the controller is damaged, it stops all motor output and signals a fault to the main display (Hand Control or Display Module).

The Powerbase 120A also features *Motor Current Foldback* and *Motor Stall Detection*. The following list describes the features and the relevant parameters on the Motor menu:

- Motor Current Foldback is a current reduction that occurs when the current exceeds MOTOR CURRENT FOLDBACK THRESHOLD on either channel for the period specified by MOTOR CURRENT LIMIT TIME.

  The current reduces to the current specified by MOTOR CURRENT FOLDBACK for the period specified by the MOTOR CURRENT LIMIT TIME.

- Motor Stall Detection ensures there is no motor output and the brakes engage when the current exceeds the MOTOR STALL CURRENT THRESHOLD for the period specified by MOTOR STALL TIME THRESHOLD and the speed is less than the speed specified with MOTOR STALL SPEED THRESHOLD.

Each brake output is PWM-controlled up to 24 VDC. Two voltages are available for configuration; the voltages are configured by the APPLY VOLTAGE and CONTINUOUS VOLTAGE parameters on the Brake Settings menu. APPLY VOLTAGE ensures the brakes release, and CONTINUOUS VOLTAGE ensures the brakes do not get re-engaged. The brake output voltage is consistent regardless of the battery voltage. The maximum continuous current rating for each brake output is 1.5A.

If either the motor or brake connection is disconnected or shorted, the system will not be operable and the corresponding faults will be raised. To clear the faults, the system must be powered down and the connections should be checked.

Battery Connection

The nominal voltage of the battery connection (B+/B−) is 24VDC. An internal relay is used to protect against polarity swap. See Battery Specifications.

Encoder Feedback

The 120A Powerbase provides an independent +5VDC encoder supply for each motor. The Powerbase supports 60–256 pulses per revolution at a motor speed of 5500 RPM.

If the wheelchair is equipped with an encoder, the MOTOR ENCODERS ENABLED parameter must be set to Yes, and the MOTOR ENCODERS PULSES PER REV. and MOTOR ENCODER INVERTED parameters must be correctly set. See System: Encoders Menu.

If the encoder function is enabled and the Powerbase detects that an encoder is not connected or is shorted, the system will display a warning intermittently. The system will still be operable, but without encoder feedback.

Push Mode

A user can push the wheelchair by manually releasing the motor brake. If the brake lever is released while the system is on and a drive command is active, a fault will be raised. If a fault is raised, the user must manually engage the brake and power cycle the system.

If the brake lever is released while the system is off, the user should manually engage the brake before powering on. Otherwise, the system will boot up with a corresponding brake fault.

Gyro Stability Control

The Powerbase includes Gyro Stability Control options. This enables a high degree of control while the wheelchair is turning, and also allows better straight-line tracking over obstacles and on uneven terrain. Gyro technology works by maintaining the desired drive direction irrespective of the external forces acting on the wheelchair.

High-speed, front-wheel-drive type wheelchairs gain the most benefit from the addition of a gyro. However, the technology will also offer vastly improved drive performance on mid-wheel-drive and rear-wheel-drive models when they are used with switch-type specialty controls.

The Gyro system in the Powerbase is self-calibrating, so no additional calibration work is required in the field when the Gyro function is enabled.

Onboard Charging

The Powerbase supports connecting an onboard charger through the J2 or J6 Molex connector. If the charger is actively charging, the system will drive the Inhibit Line (Pin 9) high or low to prevent driving. Depending on the charger, the CHARGER INHIBIT parameter on the Charger menu must be set accordingly (high active or low active).

Switch Inputs

There are two switch inputs on the J2 Molex connection. The switches are programmable for a variety of functions. For information on all options, see Mapped I/O.

Seating

The enAble X1 system offers multiple seating modules that support actuator output and feedback, programmable switches, and lights. The modules also include an inclination sensor, and are described in the following topics. See Module Compatibility.

Note:

The OEM is responsible for adding appropriate temperature protection in the actuator motor. The probability of overheating can be lowered by choosing an adequate motor.

Advanced 5 Actuator Module (AAM5)

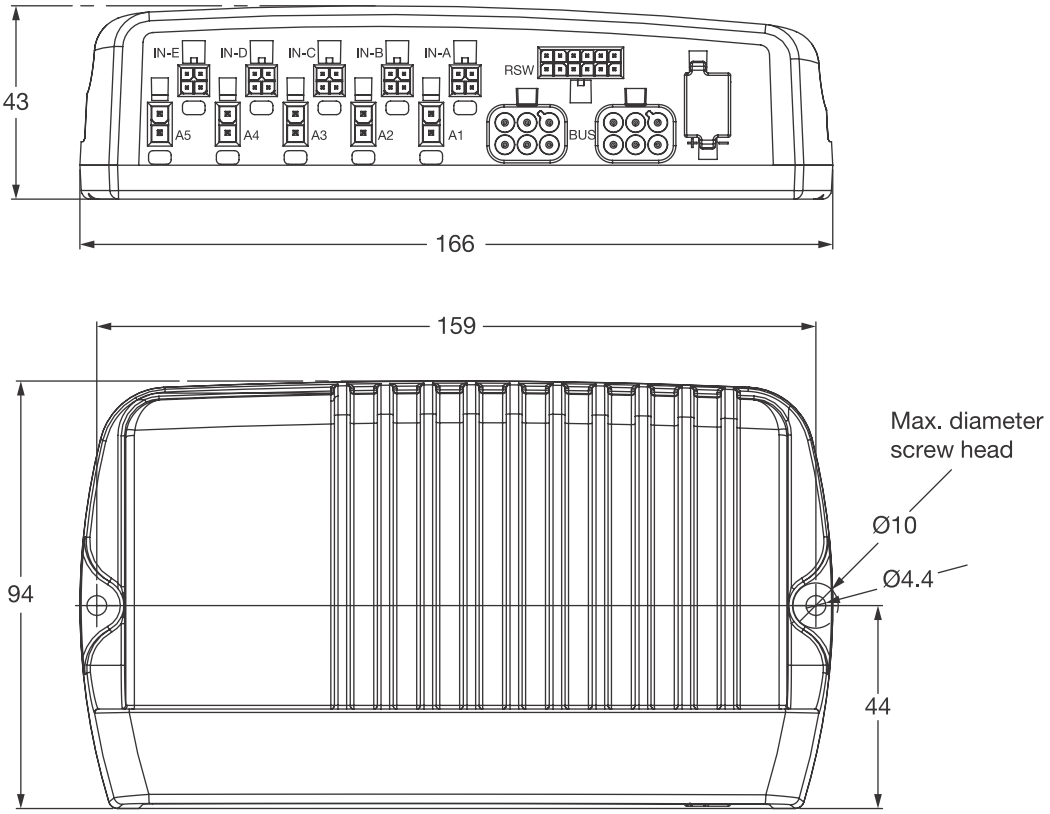
The Advanced 5 Actuator Module (AAM5) has five actuator outputs, each with optional feedback. The AAM5 also supports ten remote switches, which are programmable to different functions.

Figure 32. Advanced 5 Actuator Module

AAM5 Mounting Diagram

Figure 33 describes the mounting dimensions of the Advanced 5 Actuator Module.

Figure 33. AAM5 Outline and Mounting



AAM5 Wiring Diagrams

Figure 34 shows the AAM5 connectors, and Figure 35 describes how to wire the connectors. Table 14 lists the mating connectors.

Figure 34. AAM5 Connectors

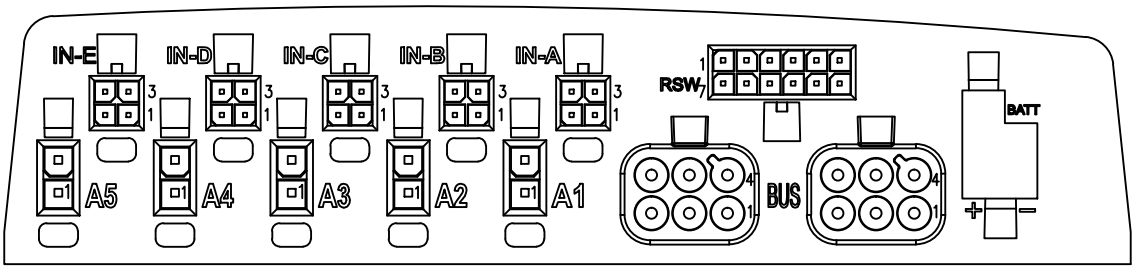


Figure 35. AAM5 Wiring

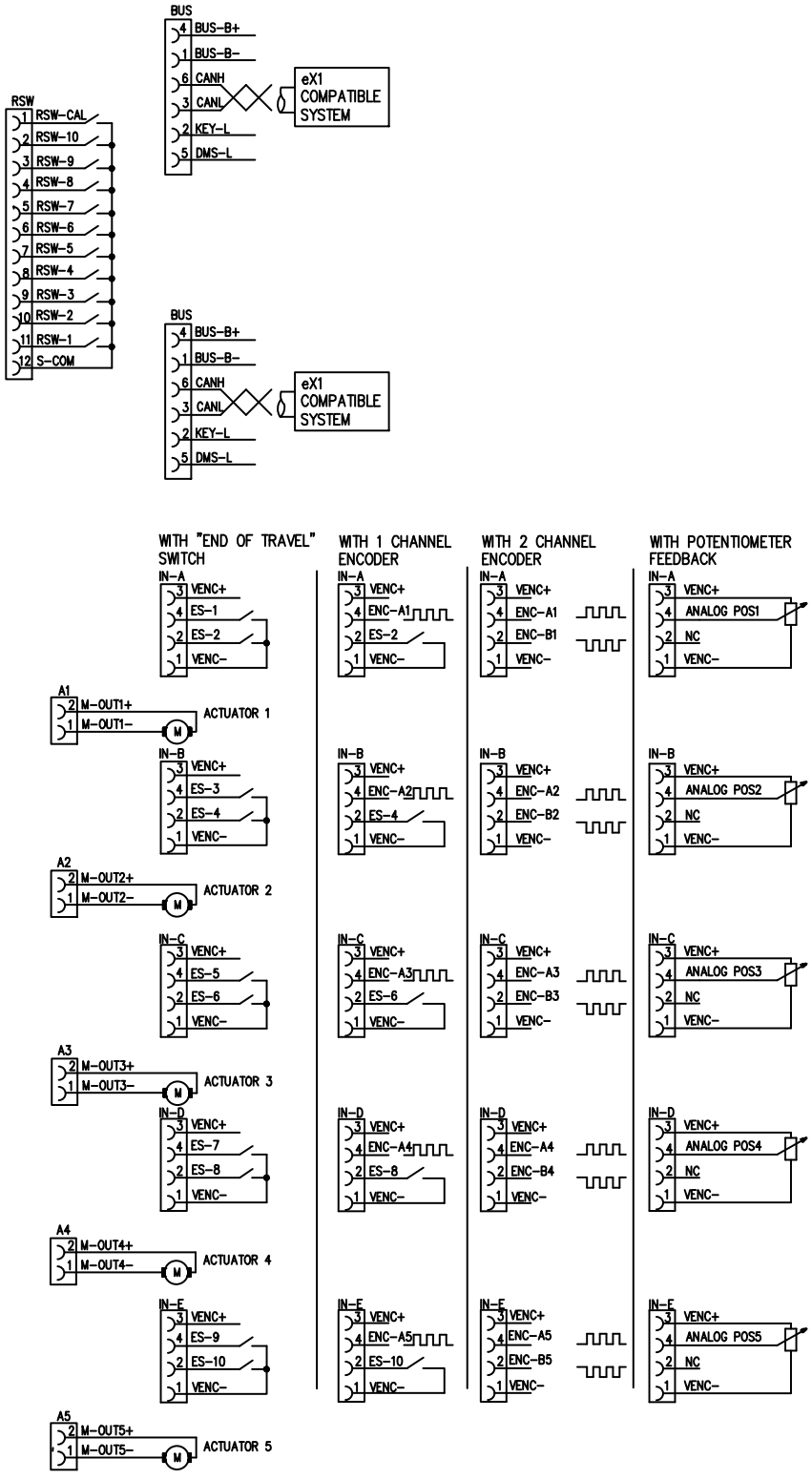


Table 14. AAM5 Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
A1 through A5	• Two-pin Mini-Fit Jr. (e.g., 39-01-3028) • Crimp female terminal Mini-Fit: ◦ 9A: Series 5556 ◦ 12A: Series 44476
IN-A through IN-E	Four-pin Micro-Fit (e.g., 43025-0400)
RSW	• 12-pin Micro-Fit (e.g., 43025-1200) • Crimp female terminal: Micro-Fit Series 43030

Actuator Outputs

Each AAM5 actuator port is rated for 24V, 15A for 10 seconds and 10A continuous.

Table 15. Advanced 5 Actuator Module Outputs

Current	Time
15A	Peak
10A	Continuous
15A	Continuous for all actuators that are running simultaneously. This is restricted by the bus current.

Actuator Feedback

The five feedback ports (IN-A to IN-E) can be used for end switch, potentiometer, and Hall sensor feedback. Creating a drive, actuator, or seat restriction with potentiometer or Hall sensor feedback is also supported.

End Switches: Depending on the switch state, a drive, actuator, or seat restriction is possible. The switches can be configured as normally open (NO) or normally closed (NC). The AAM5 provides ten end switch inputs, with two end switches per port.

Note:

The current of the actuators that are running simultaneously could exceed the bus current rating. When configuring Memory seating, use a duration test or bus current measurements to ensure that the bus current is within the specified limits.

Inclination Sensing

The built-in sensor is used to create drive, actuator, and seat restrictions. For the sensor to work properly, the applicable parameters must be configured to match the actuator module mounting. See Seat Configuration for a more detailed explanation.

Remote Switch Inputs

The module provides ten switch inputs on the RSW Molex connection. The switches are programmable for a variety of functions. For information on the available options, see Mapped I/O.

Actuator Module 3 and Actuator Module 3 with LED Lights (AM3/AM3L)

The Actuator Module 3 (AM3) and Actuator Module 3 with LED Lights (AM3L) have three actuator outputs. Each output provides optional feedback. The AM3L also provides LED lights.

Figure 36. Actuator Module 3 with Lights

Actuator Module 3 Mounting and Wiring Diagrams

Figure 37 describes how to mount the AM3. Figure 38 and Figure 39 describe how to wire the Actuator Module 3. (The diagrams are for the AM3L model, but, with the exception of the light connector, also apply to the AM3 model.) Table 16 describes the mating connectors.

Figure 37. AM3L Outline and Mounting

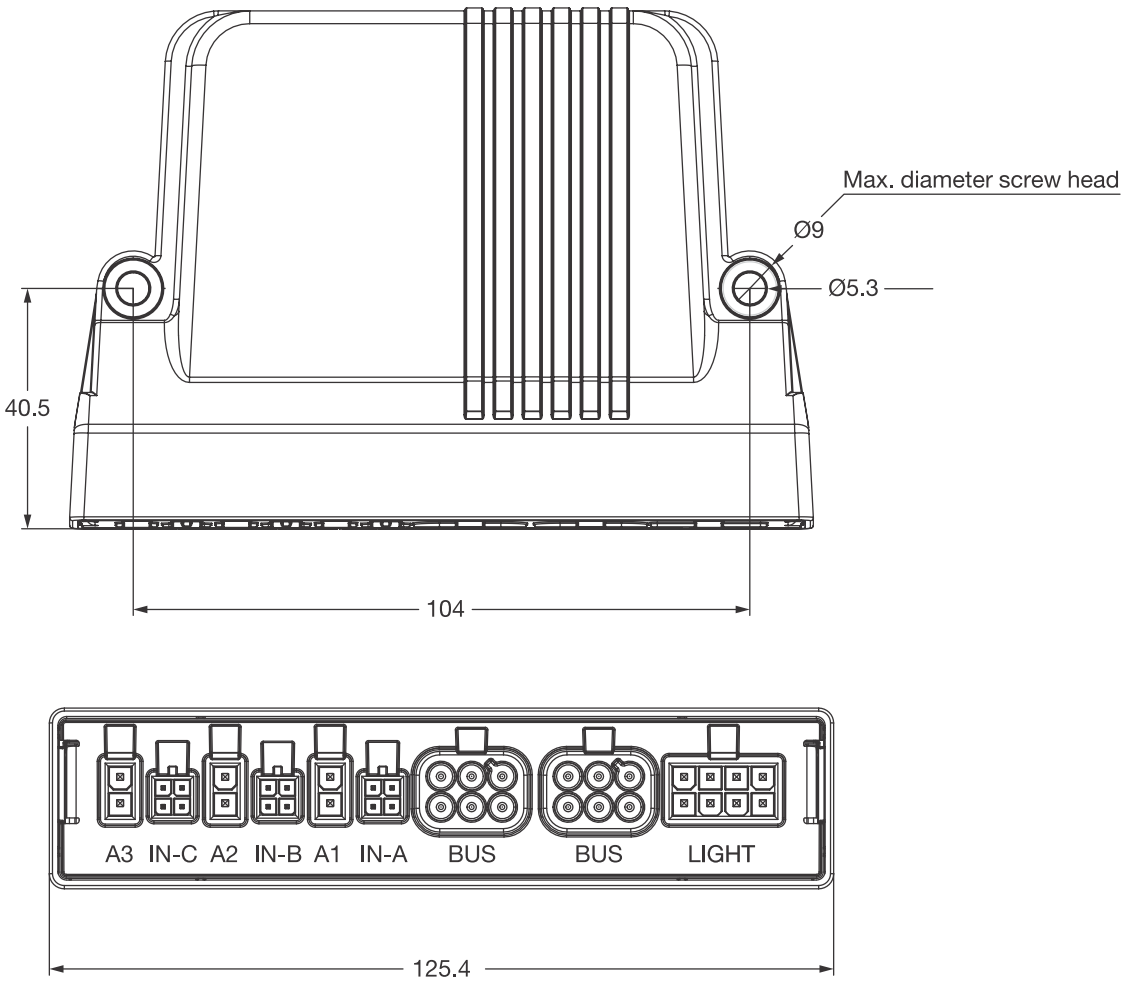


Figure 38. AM3L Connectors

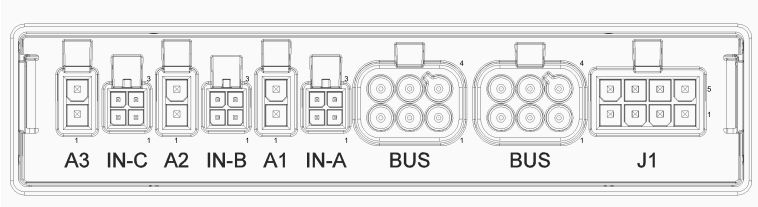


Figure 39. AM3L Wiring

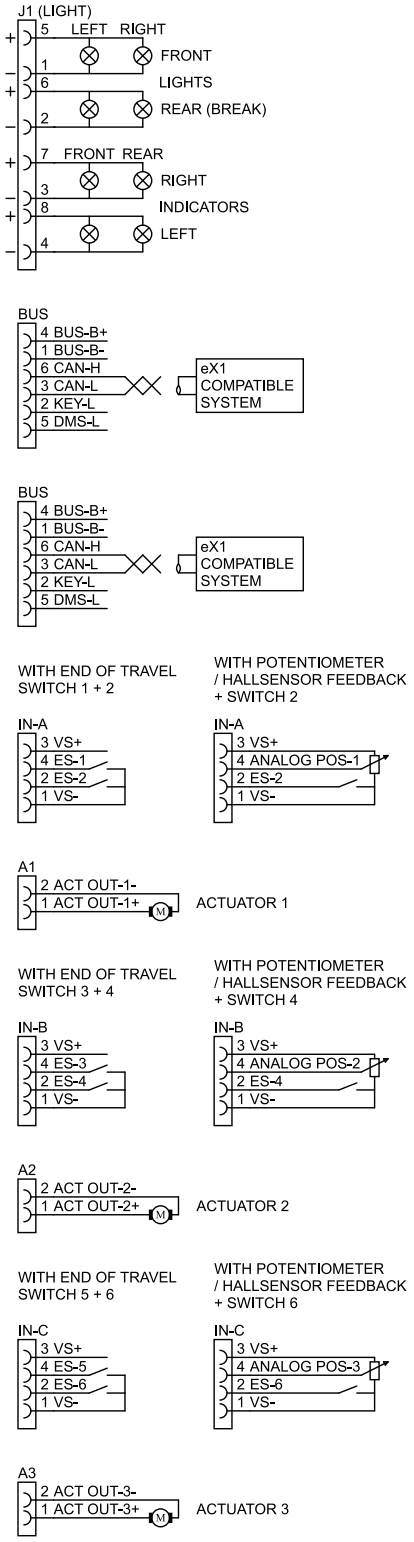


Table 16. AM3L Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
A1 and A2	• Two-pin Mini-Fit Jr. (e.g., 39-01-3028) • Crimp female terminal Mini-Fit: ◦ 9A: Series 5556 ◦ 12A: Series 44476
Light	• Eight-pin Mini-Fit Jr. (e.g., 39-01-2085) • Crimp female terminal Mini-Fit: ◦ 9A: Series 5556 ◦ 12A: Series 44476
IN-A and IN-B	• Four-pin Micro-Fit (e.g., 43025-0400) • Crimp female terminal: Micro-Fit Series 43030

Actuator Module 3 Outputs

Each AM3 and AM3L actuator port is rated for 24V, 12A for 10 seconds and 8A continuous.

Table 17. Actuator Module 3 Outputs

Current	Time
12A	Peak
8A	Continuous
15A	Maximum 2 second use

Actuator Feedback

The three feedback ports (IN-A to IN-C) can be used for end switch, potentiometer, and Hall sensor feedback. Creating a drive, actuator or seat restriction with potentiometer or Hall sensor feedback is also supported.

End Switches: Depending on the switch state, a drive, actuator, or seat restriction is possible. The switches can be configured as normally open (NO) or normally closed (NC). The AM3 and AM3L provide six end switch inputs, two per port.

Note:

The current of the actuators that are running simultaneously could exceed the bus current rating. When configuring Memory seating, use a duration test or bus current measurements to ensure that the bus current is within the specified limits.

Inclination Sensing

The built-in sensor is used to create drive, actuator, and seat restrictions. For the sensor to work properly, the applicable parameters must be configured to match the actuator module mounting. See Seat Configuration for a more detailed explanation.

Lights and Indicators

The light voltage outputs are programmable from 6–12V. To program the light voltage outputs, use the Lights parameters. The following table describes the current ratings.

Table 18. AM3L Light Output Current Rating

Current	Time
1A	Peak
1A	Continuous
1.5A	Continuous for all 4 outputs together

The lights can be controlled by the following:

- Mapped soft keys on the Hand Control Standard
- Mode jacks on the Hand Control and Display Module
- Remote switches on Advanced Actuator Module and Powerbase models
- Mapped I/O on the Enhanced Switch Module
- The **Auxiliary** menu on the Display Module

The system must be powered on for the lights to operate. If the system is powered off while the hazards are active, the hazards will remain on.

Advanced 2 Actuator Module with Lights (AAM2L)

The Advanced 2 Actuator Module with Lights (AAM2L) provides two outputs for front and rear lights and two outputs for left and right indicators. The AAM2L also has two actuator outputs.

Figure 40. Advanced 2 Actuator Module with Lights

Advanced 2 Actuator Module with Lights Mounting and Wiring Diagrams

Figure 41 describes how to mount the AAM2L. Figure 42 and Figure 43 describe how to wire the Advanced 2 Actuator Module with Lights. Table 19 describes the mating connectors.

Figure 41. AAM2L Outline and Mounting

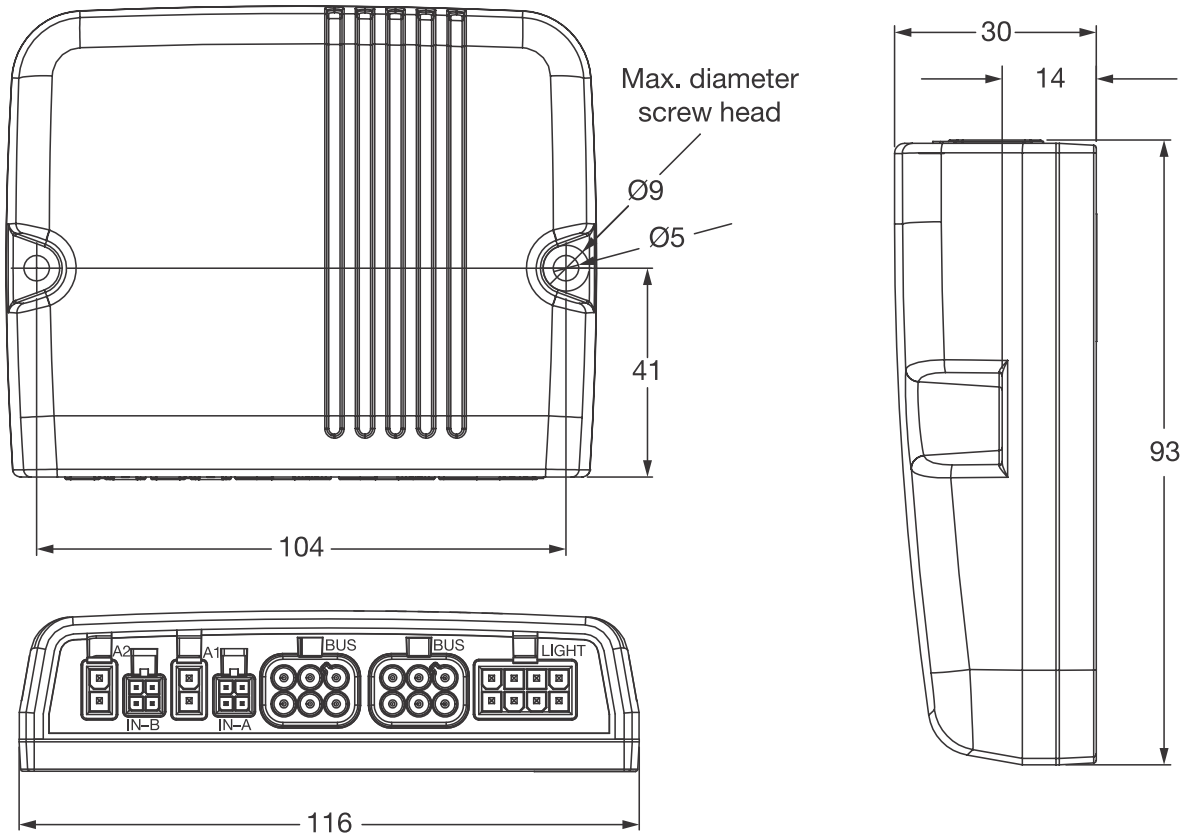


Figure 42. AAM2L Connectors

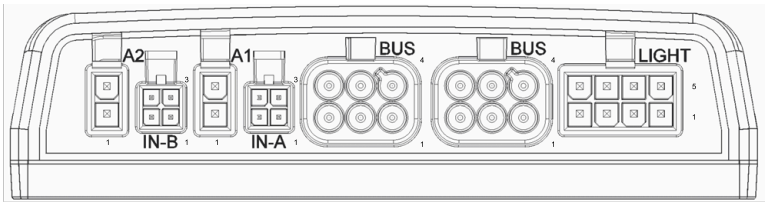


Figure 43. AAM2L Wiring

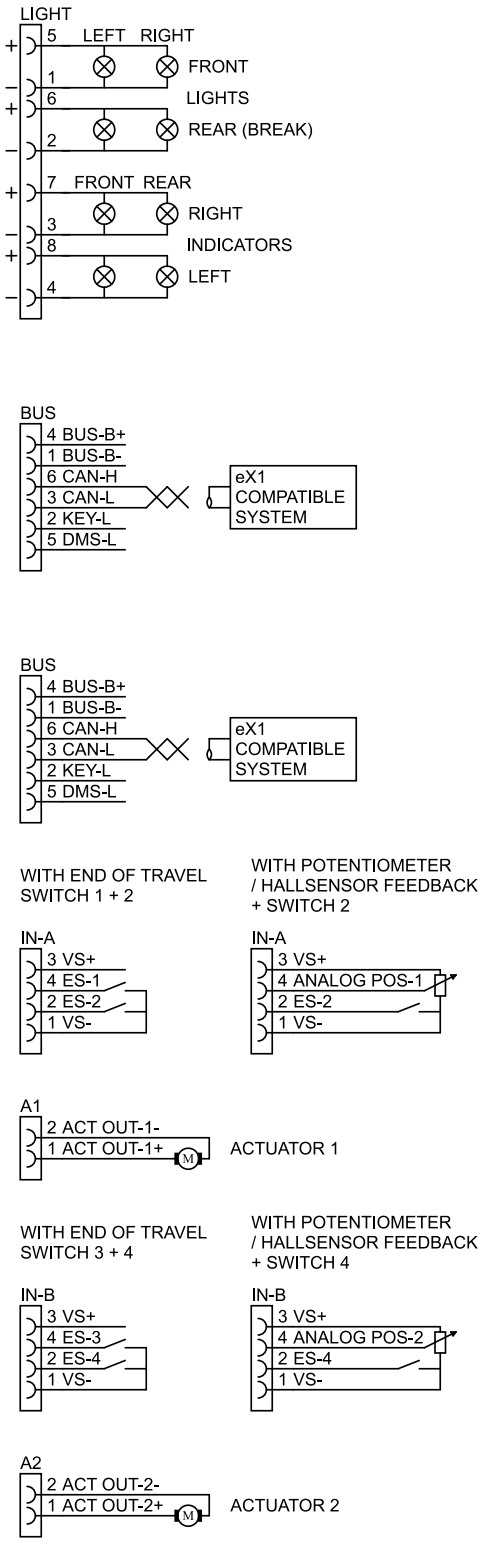


Table 19. AAM2L Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
A1 and A2	• Two-pin Mini-Fit Jr. (e.g., 39-01-3028) • Crimp female terminal Mini-Fit: ◦ 9A: Series 5556 ◦ 12A: Series 44476
Light	• Eight-pin Mini-Fit Jr. (e.g., 39-01-2085) • Crimp female terminal Mini-Fit: ◦ 9A: Series 5556 ◦ 12A: Series 44476
IN-A and IN-B	• Four-pin Micro-Fit (e.g., 43025-0400) • Crimp female terminal: Micro-Fit Series 43030

Advanced 2 Actuator Module Outputs

Each AAM2L actuator port is rated for 24V, 15A for 10 seconds and 10A continuous.

Table 20. Advanced 2 Actuator Module Outputs

Current	Time
15A	Peak
10A	Continuous
15A	Restricted by the maximum bus current

Actuator Feedback

The two feedback ports (IN-A and IN-B) can be used for end switch, potentiometer, and Hall sensor feedback. Creating a drive, actuator, or seat restriction with potentiometer or Hall sensor feedback is also supported.

End Switches: Depending on the switch state, a drive, actuator, or seat restriction is possible. The switches can be configured as normally open (NO) or normally closed (NC). The AAM2L provides four end switch inputs, with two end switches per port.

Note:

The current of the actuators that are running simultaneously could exceed the bus current rating. When configuring Memory seating, use a duration test or bus current measurements to ensure that the bus current is within the specified limits.

Inclination Sensing

The built-in sensor is used to create drive, actuator, and seat restrictions. For the sensor to work properly, the applicable parameters must be configured to match the actuator module mounting. See Seat Configuration for a more detailed explanation.

Lights and Indicators

The light voltage outputs are programmable from 6–24V. To program the light voltage outputs, use the Lights parameters. The following table describes the current ratings.

Table 21. AAM2L Light Output Current Rating

Current	Time
2A	Peak
1A	Continuous
3A	Continuous for all four outputs together

The lights can be controlled by the following:

- Mapped soft keys on the Hand Control Standard
- Mode jacks on the Hand Control and Display Module
- Remote switches on Advanced Actuator Module and Powerbase models
- Mapped I/O on the Enhanced Switch Module
- The **Auxiliary** menu on the Display Module

The system must be powered on for the lights to operate. If the system is powered off while the hazards are active, the hazards will remain on.

Miscellaneous Modules

The following sections describe modules other than input, powerbase, and actuator modules.

Servo Steer Lighting Module (SM2L)

The Servo Steer Lighting Module (SM2L) provides two servo steer motor outputs (A1 and A2). Each motor output has feedback options and an option for LED Lights.

The SM2L is available only with systems that include the Hand Control Standard (HCS) or Display Module (DM).

Figure 44. Servo Steer Lighting Module

Note:

Connectors A3 and IN-C are non-functional.

SM2L Mounting and Wiring Diagrams

Figure 45 and Figure 46 describe how to mount and wire the Servo Steer Lighting Module.

Figure 45. SM2L Outline and Mounting

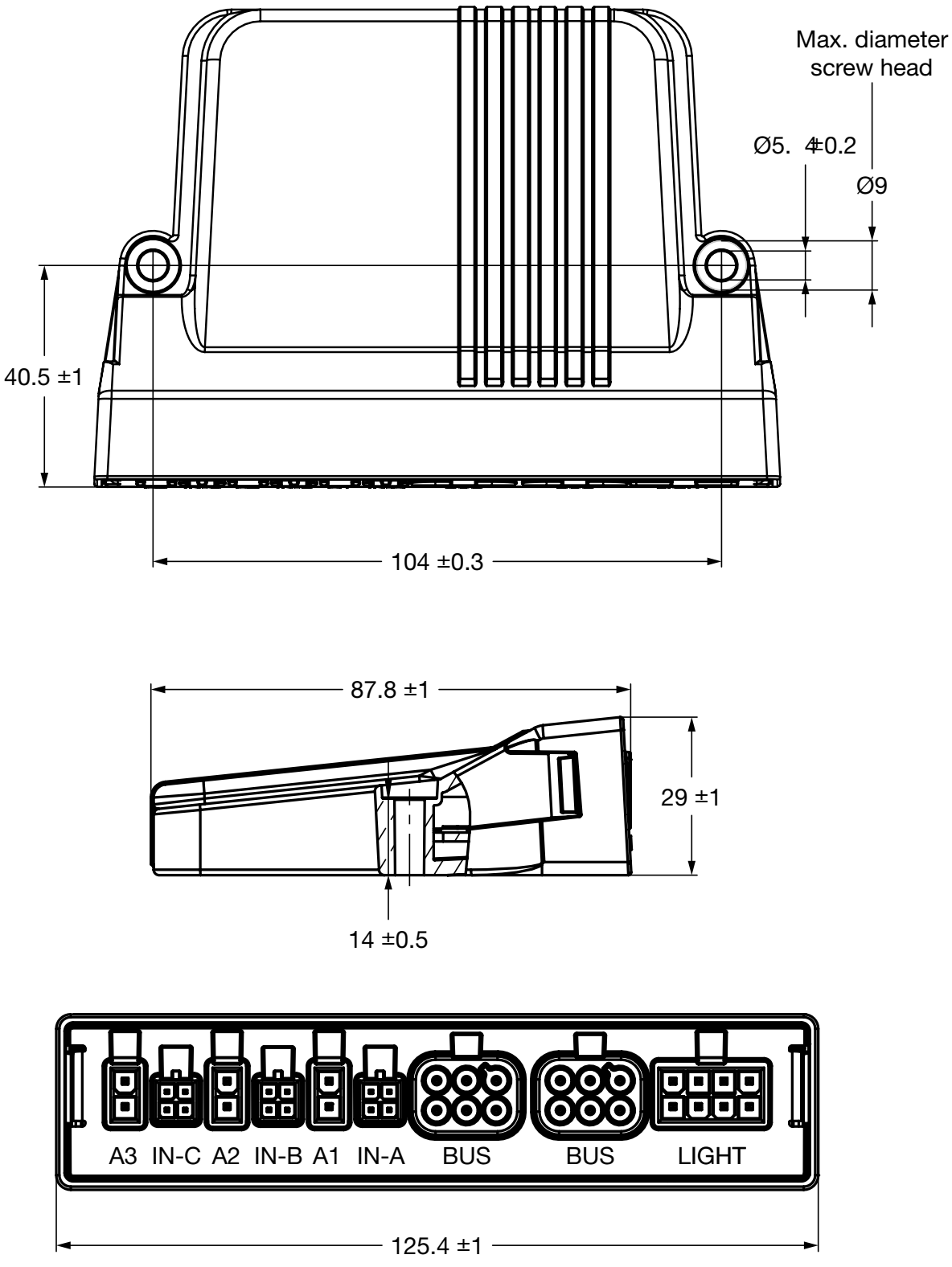
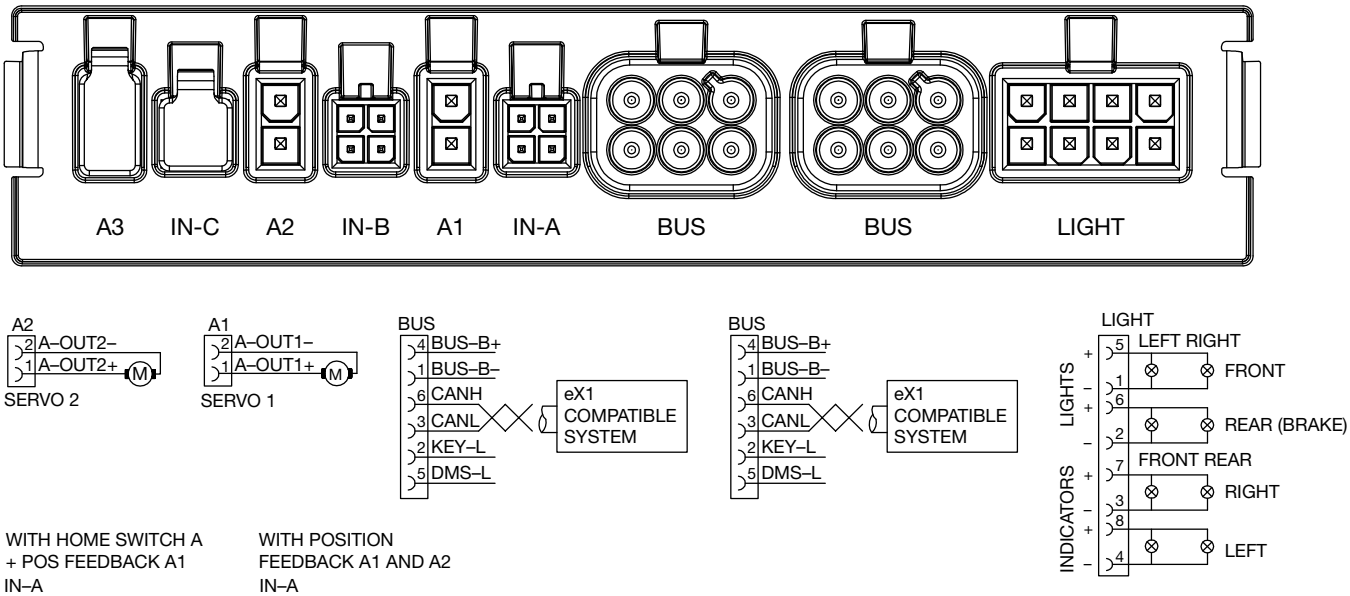


Figure 46. SM2L Wiring



MATING CONNECTORS:

BUS: eX1 BUS CABLE CURTIS

A1 – A2: 2PIN MINIFIT Jr e.g. 39–01–3028

LIGHT: 8PIN MINIFIT Jr e.g. 39–01–2085

CRIMP FEMALE TERMINAL MINIFIT

9 AMPS SERIES 5556

12 AMPS SERIES 44476

In–A – In–B: 4PIN MICROFIT e.g. 43025–0400

CRIMP FEMALE TERMINAL MICROFIT SERIES 43030

Servo Motor Outputs

Each SM2L motor port is rated for 24V, 12A for 10 seconds, and 8A continuous.

Table 22. SM2L Light Output Current Rating

Current	Time
12A	Peak
8A	Continuous
15A	Maximum 2 second use

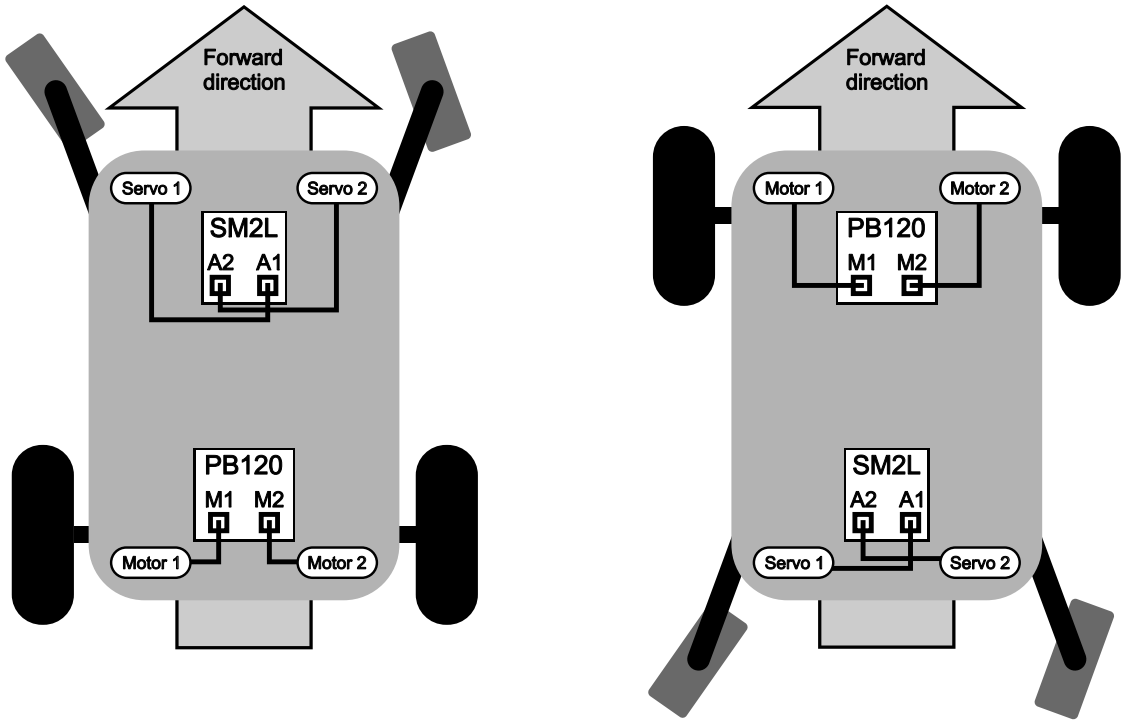
Servo Motor Feedback

The two feedback ports (IN-A and IN-B) can be used for potentiometer or Hall sensor feedback.

Servo Steer Motor Setup

The following diagram shows how to wire servo motors for both front-wheel and rear-wheel drives.

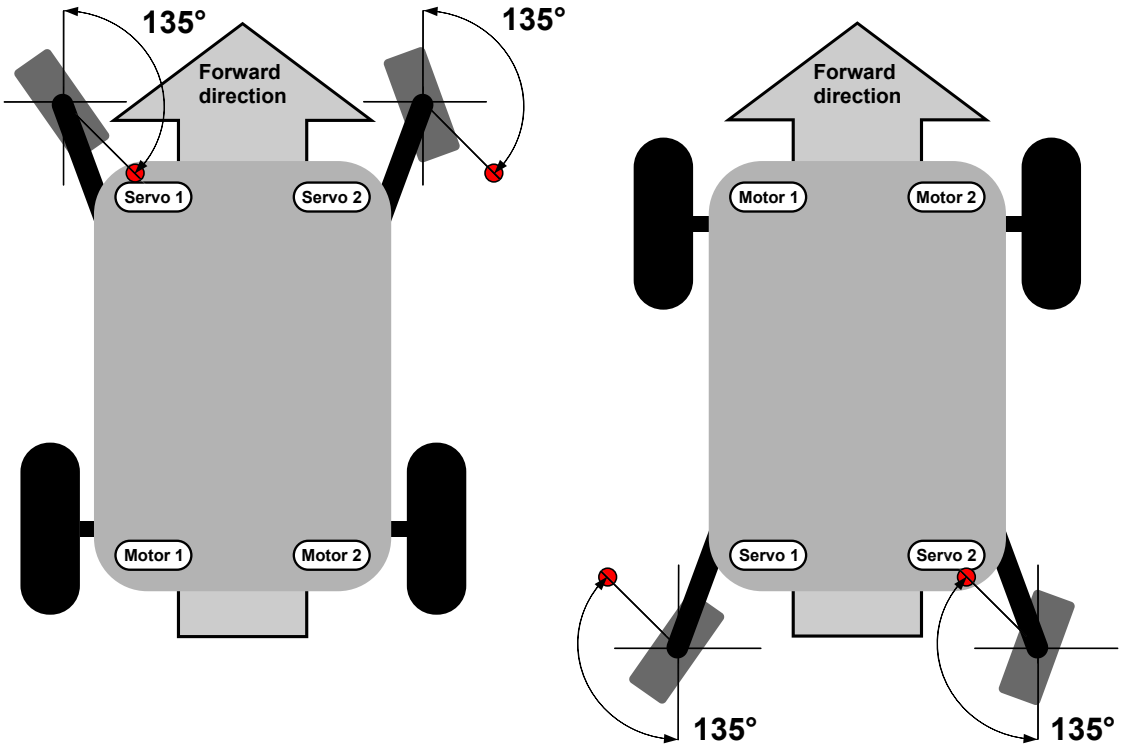
Figure 47. Wiring Servo Motors



At the zero position, the sensor has a jump between the minimum and maximum values. The zero position influences driving behavior significantly. For this reason, the zero position should be at a location that is as

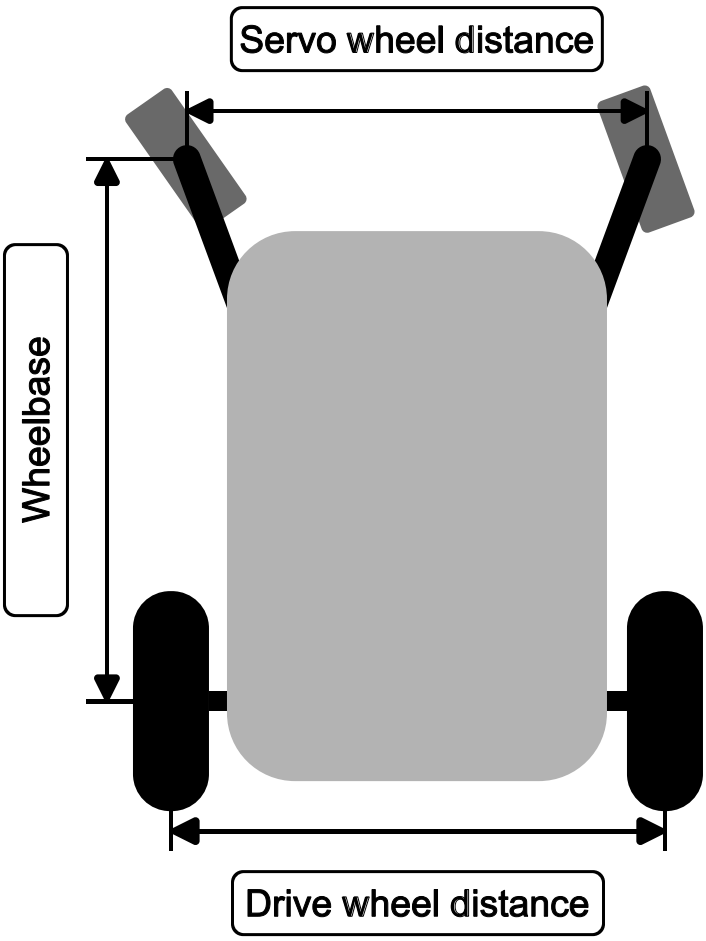
uncritical as possible for driving straight in the forward direction, at the sensor range limit near the 135° position. Refer to the following diagram.

Figure 48. Servo Motors, Zero Position



Servo Wheel Settings

The following diagram shows the measurements that must be taken when setting up the servo steering parameters. See System: Servo Menu.



Lights and Indicators

The light voltage outputs are programmable from 6–12V. To program the light voltage outputs, use the Lights parameters. The following table describes the current ratings.

Table 23. SM2L Light Output Current Rating

Current	Time
1A	Peak
1A	Continuous
1.5A	Continuous for all four outputs together

The lights can be controlled by the following:

- Direct access soft keys on the Hand Control Basic
- Mode jacks on the Hand Control (one function only)

The system must be powered on for the lights to operate. If the system is powered off while the hazards are active, the hazards will remain on.

LED Light Module (LML)

The LED Light Module (LML) provides two outputs for front and rear lights and two outputs for left and right indicators.

Note:

Unlike the actuator models with lights (AM3L and AAM2L), the LML does not have actuator outputs.

Figure 49. LED Light Module

LML Mounting and Wiring Diagrams

Figure 50 and Figure 51 describe how to mount and wire the LED Light Module.

Figure 50. LML Outline and Mounting

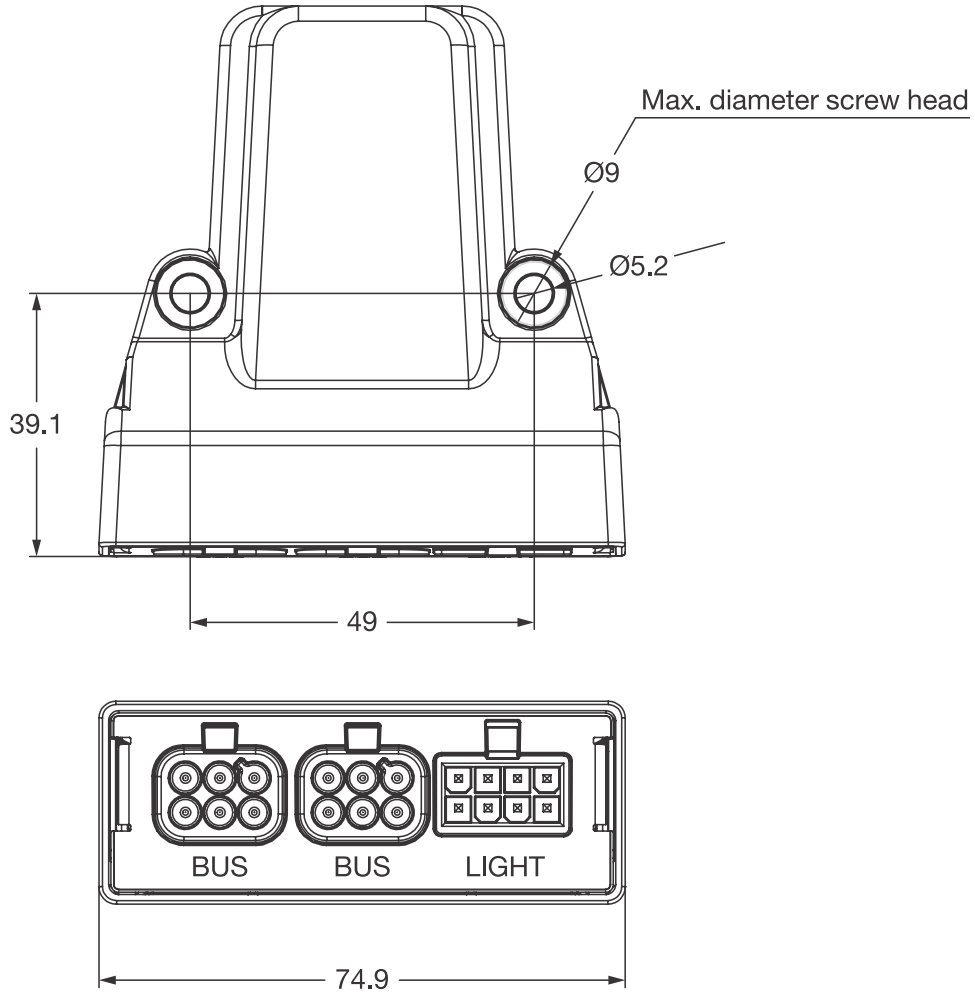
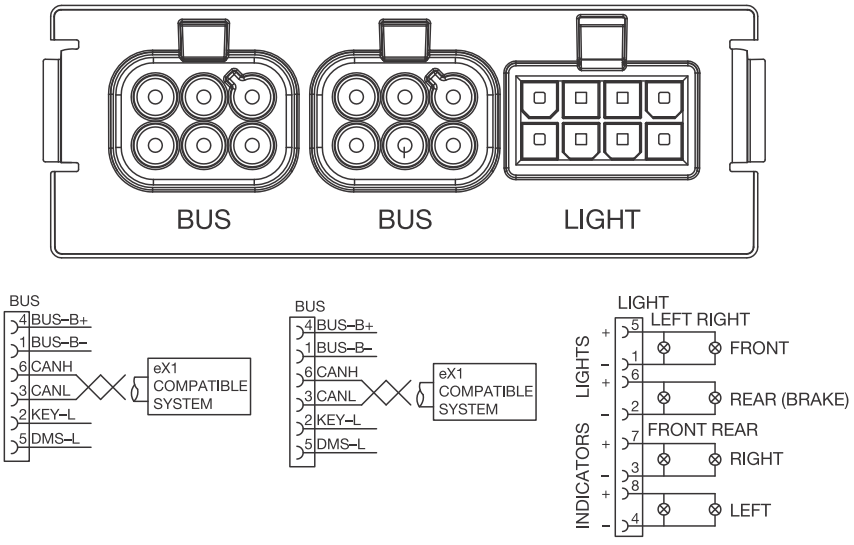


Figure 51. LML Wiring



MATING CONNECTORS

BUS: eX1 BUS Cable Curtis
Light: 8 Pin MiniFit Jr
Crimp Female Terminal MiniFit
9 Amps Series 5556
12 Amps Series 44476

Lights and Indicators

The light voltage outputs are programmable from 6–12V. To program the light voltage outputs, use the Lights parameters. The following table describes the current ratings.

Current	Time
1A	Peak
1A	Continuous
1.5A	Continuous for all four outputs together

The lights can be controlled by the following:

- Mapped soft keys on the Hand Control Standard
- Mode jacks on the Hand Control and Display Module
- Remote switches on Advanced Actuator Module and Powerbase models
- Mapped I/O on the Enhanced Switch Module
- The **Auxiliary** menu on the Display Module

The system must be powered on for the lights to operate. If the system is powered off while the hazards are active, the hazards will remain on.

Enhanced Switch Module (ESM)

The Enhanced Switch Module (ESM) provides switches that control functions such as operating the lights and adjusting the seat. The Enhanced Switch Module consists of four switches. The module provides inputs for many functions: there can be up to eight pages of functions, and up to two functions can be assigned to most switches on each page.

The Enhanced Switch Module is available in models with flat switches and with toggle switches. Both models provide the same functions.

Figure 52. Toggle Switch Model, Enhanced Switch Module

Figure 53. Flat Switch Model, Enhanced Switch Module

The following table describes the items highlighted in Figure 53:

Item	Description
1	OLED display
2	LED feedback. There are four LEDs (one per switch).
3	Switches

For information on Enhanced Switch Module operation and features, see the *enAble X1 User Guide*. For information on configuring the ESM, see ESM Configuration.

ESM Mounting and Wiring Diagrams

Figure 54 and Figure 55 describe how to mount and wire the Enhanced Switch Module.

Figure 54. ESM Outline and Mounting

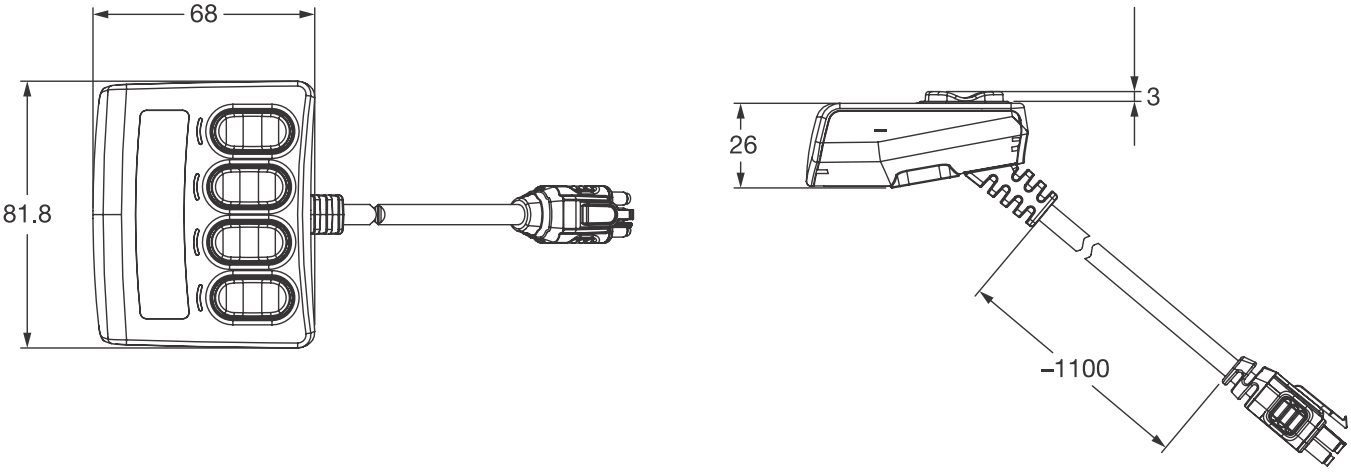
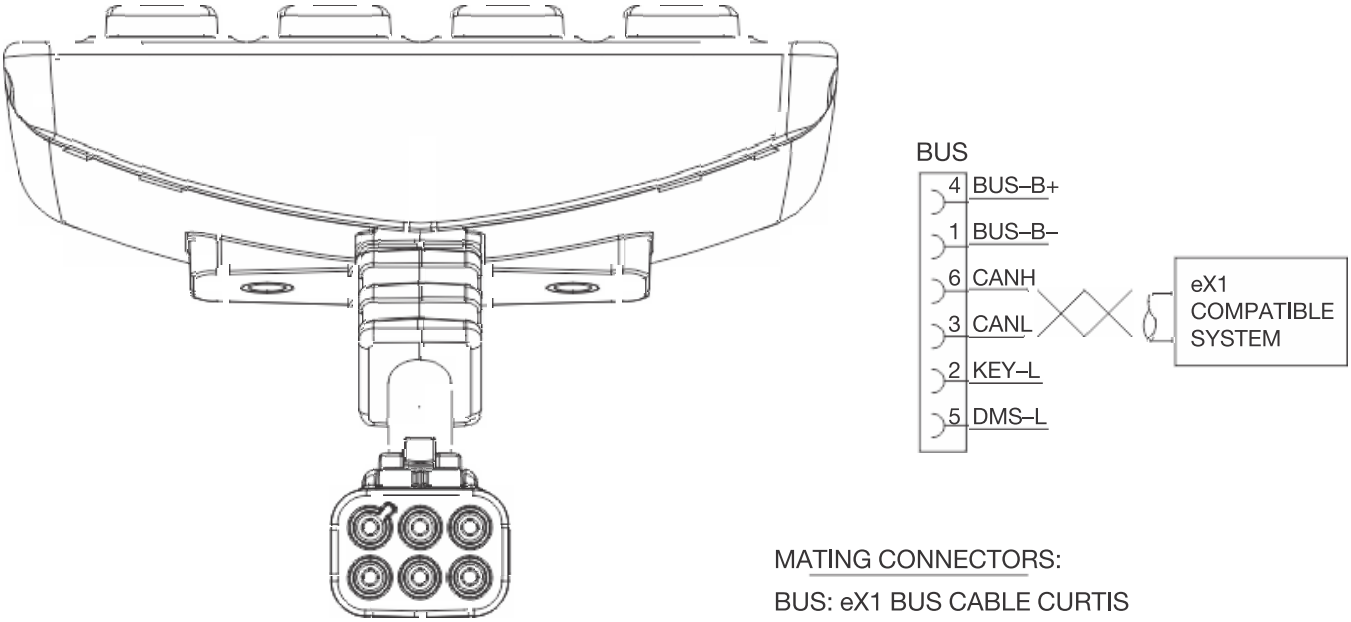


Figure 55. ESM Wiring



Environmental Control Module (ECM)

The Environmental Control Module (ECM) consists of five relays. The relays allow for control of an external device. Up to ten functions that activate or deactivate any combination of the relays can be programmed. Each function can be controlled through the Display Module's **Settings** menu, Mapped I/O, or the ESM.

Figure 56. Environmental Control Module

ECM Mounting and Wiring Diagrams

Figure 57 and Figure 58 describe how to mount and wire the Environmental Control Module.

Figure 57. ECM Outline and Mounting

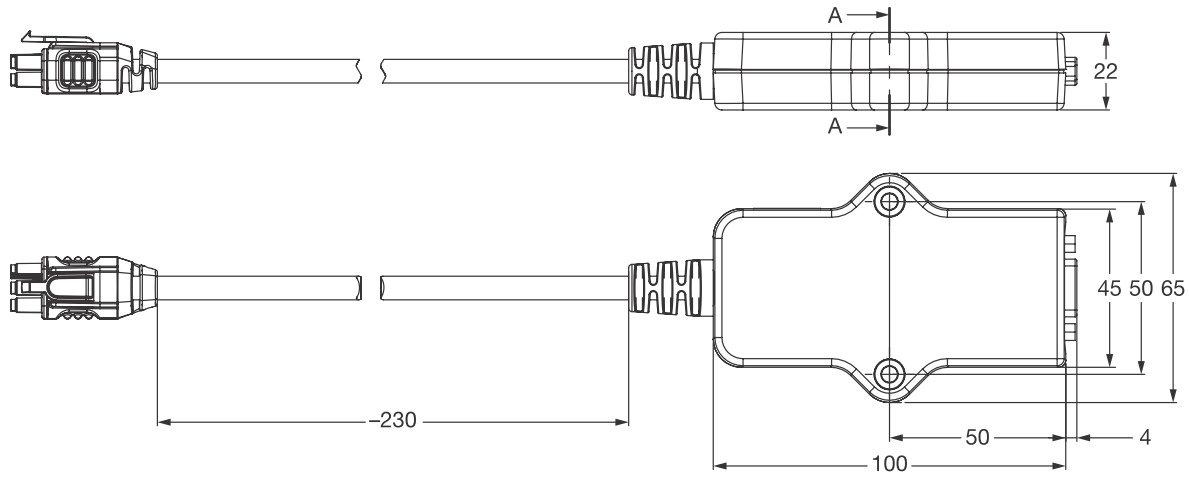
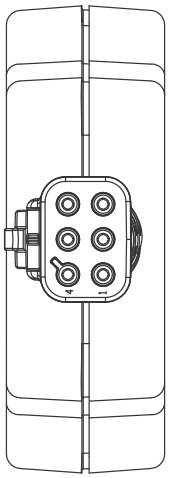


Figure 58. ECM Wiring



BUS

4	BUS–B+
1	BUS–B–
6	CANH
3	CANL
2	KEY–L
5	DMS–L

eX1 COMPATIBLE SYSTEM

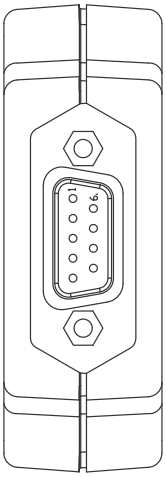
MATING CONNECTORS:

BUS: eX1 BUS CABLE CURTIS

D–SUB: DB9 MALE

D–SUB
(RELAY)

1	RELAY 1
2	RELAY 2
3	RELAY 3
4	RELAY 4
5	RELAY 5 NO
6	COM–SUPPLY
7	RELAY 5 NC
8	COM–RELAY
9	+12V



CONNECTION EXAMPLES

POWERING A LOAD WITH INTERNAL +12V

1	RELAY 1
2	RELAY 2
3	RELAY 3
4	RELAY 4
5	RELAY 5 NO
6	COM–SUPPLY
7	RELAY 5 NC
8	COM–RELAY
9	+12V

LOAD

CONTROLLING A LOAD WITH EXTERNAL SUPPLY

1	RELAY 1
2	RELAY 2
3	RELAY 3
4	RELAY 4
5	RELAY 5 NO
6	COM–SUPPLY
7	RELAY 5 NC
8	COM–RELAY
9	+12V

LOAD

SWITCH WTH PULLUP

9	+12V
1	RELAY 1
2	RELAY 2
3	RELAY 3
4	RELAY 4
5	RELAY 5 NO
6	COM–SUPPLY
7	RELAY 5 NC
8	COM–RELAY

SWITCH INPUTS (12V)

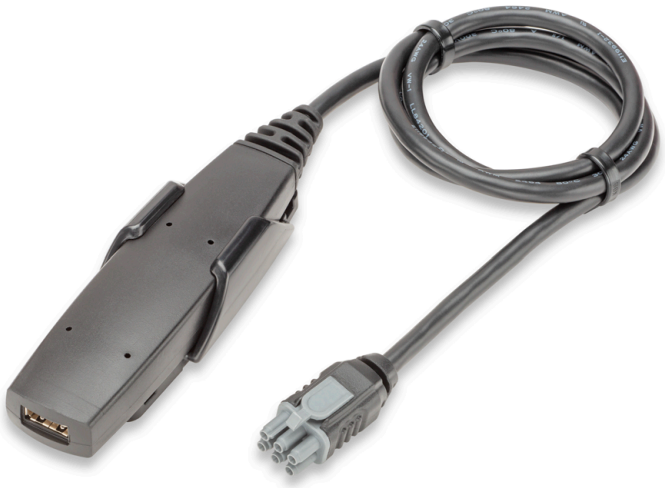
GND

Power Supply Module (PSM)

The Power Supply Module (PSM) is a USB Type-A charger. The PSM is active only while the system is powered on. If the PSM reaches 50°C, the output voltage is reduced.

The PSM is rated for a 1.5A output current with a 5V output voltage.

Figure 59. Power Supply Module



PSM Mounting and Wiring Diagrams

Figure 60 describes how to mount the Power Supply Module. Figure 61 and Figure 62 describe how to wire the PSM. Table 24 describes the mating connectors.

Figure 60. PSM Outline and Mounting

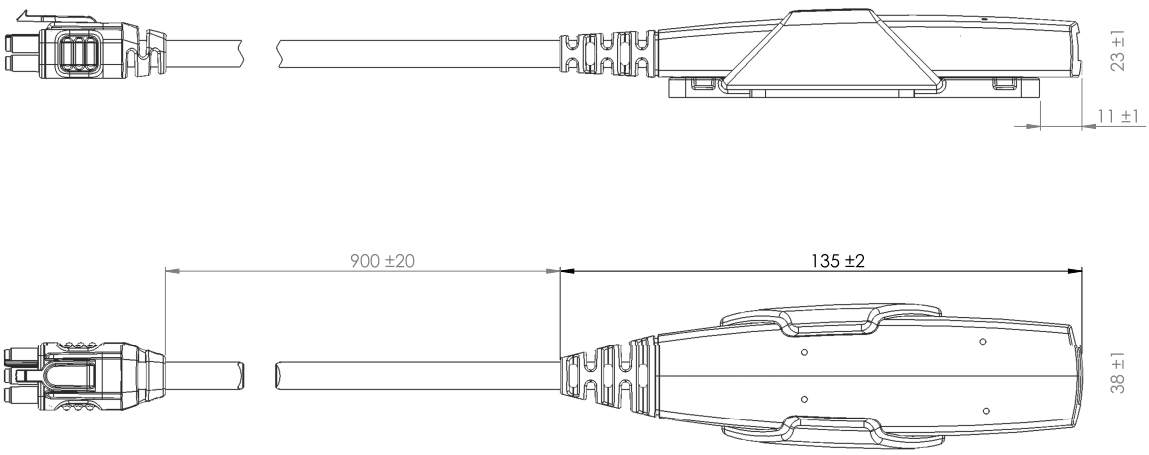


Figure 61. PSM Connectors

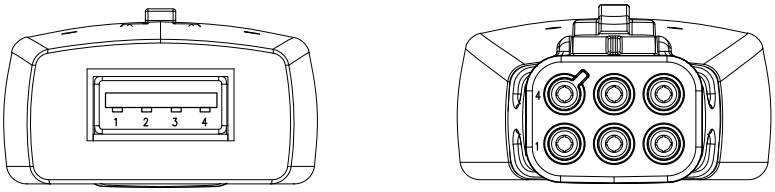
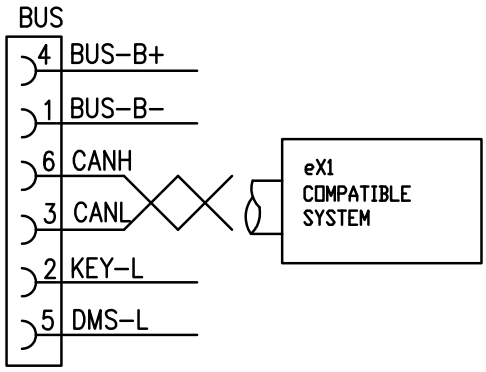


Figure 62. PSM Wiring



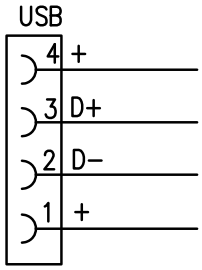


Table 24. PSM Mating Connectors

Part	Mating Connector
Bus	Curtis enAble X1 bus cable
USB	USB Type-A plug

4 — Operation

The following topics describe enAble X1 operation:

- Module Compatibility
- Powering On/Off
- Stopping
- Configurable Profiles
- Home Screen And Menu Navigation
- Input Configuration
- Configuration Management
- Bluetooth Capabilities
- ECM Operation

Note:

For more information about operating the enAble X1 system, see the *enAble X1 User Manual* manual

Module Compatibility

The enAble X1 system can be configured in different combinations. The minimum system requirement is:

- Powerbase
- Hand Control or Display Module with SCIM

The maximum system is:

- Powerbase
- Hand Control
- Display Module
- Attendant Control
- Specialty Control Input Module
- Sip & Puff
- Actuator Module (and combinations of other Actuator modules)
- Light Module
- Enhanced Switch Module
- Power Supply Module (not limited)

Powering On/Off

Power Buttons

Using the on/off push-button (HCS, HCB, DM, AC) is the standard method for powering the system on and off. Jack switches can also be configured for on/off functionality.

Auto Shutoff

An auto shutoff feature can be used up to 240 minutes after the system has been idle. Without powering down the system manually, this will shut down the system at the defined parameter setting. To disable auto shutoff, set the input module's AUTO SHUTOFF parameter to 0 min. The Parameters section describes the menus that contain AUTO SHUTOFF parameters..

System Lock

The last feature that can shut down the system is system lock. It can be initiated by:

- Selecting menu entry "System Lock" in Auxiliary – System Functions menu (DM only)
- A long mode command with any mode button or lever, for 5 seconds
- Short, long, or double jack command dependent on the configuration

Note:

This works independently of the SYSTEM LOCK setting.

If the system is shut down via system lock, there are two ways to unlock the system at the next power on:

- Forward command from active input device for 5 seconds, followed by a Reverse command for 5 seconds
- Left-right-left command from any head input device

With Attendant Control Installed

If an Attendant Control is installed on the system, it can be configured to allow powering off the system from only itself if the AC is the active input device. See AC: Joystick Setup Menu for the parameter TURN OFF.

Stopping

There are multiple ways to stop the system from driving.

Decel Stop

Reducing the drive command to neutral on the active input device is the standard method of stopping. The system reduces speed to zero with the programmed deceleration rates configured for the active drive profile. For information on the drive parameters, see User Drive Profiles Menu.

The On/Off Jack, Mode Jack and SCIM 9-pin D-sub (D-SUB MODE E-STOP) can be configured to perform a Decel Stop if the switch is pressed while driving. The jack switches will still work as configured when the system is not moving.

Quick Stop

A quick stop is initiated by moving the joystick in the opposite direction for more than 50% of the active range. The quick stop is a multiplied factor to the deceleration rate used, and can be configured for forward and reverse direction.

Example:

(FWD MAX DECEL 20%) * (DRIVE QUICK STOP FWD FACTOR 2.0) = Quick Stop Fwd Decel 40%

The On/Off Jack, Mode Jack, and SCIM 9-pin D-sub (D-SUB MODE E-STOP) can be configured to perform a Quick Stop if the switch is pressed while driving. The jack switches will still work as configured when the system is not moving.

For information on the Quick Stop parameters, see System: Chair Drive Profile Menu.

Emergency Stop

The emergency stop will occur if the system is powered off while driving, or in case of specific system hardware or software errors. The DRIVE EMERGENCY STOP parameter can be set from 25-100%, which represents a range of 2.0 – 4.0 m/s^2.

An emergency stop will take place as a result of:

- Timeout of joystick data
- DMS supervision
- Battery overvoltage
- Charger connected
- Brake disconnected
- Brake shorted
- Motor shorted
- Bus overload
- Heatsink overtemperature
- Powering off while driving

Park Brake Stop

The park brake stop is the most drastic; the motor outputs turn off immediately and the brakes are engaged. There are no parameters associated with this type of stop. It is seen only in case of serious hardware or software errors.

Configurable Profiles

Each input device has its own dedicated profile setup for up to six programmable profiles, except for the Attendant Control, which only allows four. The profile options are four programmable drive profiles, a seat profile, and an auxiliary profile. Since the AC allows four profiles total, only two drive profiles are possible. The profiles can be programmed in any order for all input devices, or disabled.

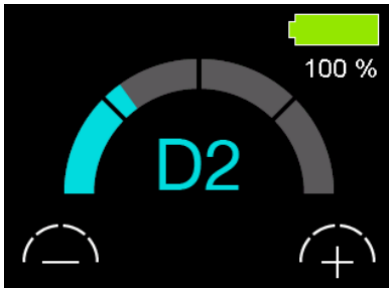
No matter which profile is active, the top of the display always shows drive status and battery percentage. Drive status and battery percentage are not shown on the HCS Home Screen.

The following sections describe the types of profiles:

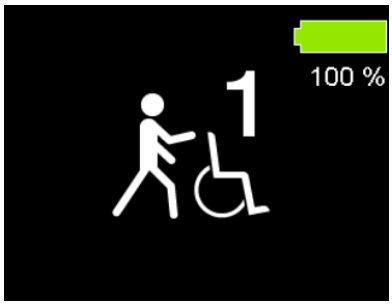
- Drive Profiles
- Seat Profiles
- Auxiliary and Settings Menu Profiles

Drive Profiles

The drive screen shows information and speed increment indication (if not disabled). If the speed up / speed down functions are not programmed to the Soft Keys, then there is no visual indication of speed adjustment, and the maximum configured drive profile parameters are used (FWD MAX SPEED, FWD MAX ACCEL, etc.).



If an Attendant Control is operating the system, the drive screen shows a different graphic with only profile indication.



Drive Profile Configuration

Each drive profile can be independently configured per input device. For example, HC Drive Profile 1 can be configured separately from AC Drive Profile 1. Drive configuration includes speed, accel, decel, power, and latch settings.

Drive Restrictions

The enAble X1 system can reduce or lockout driving due to seat position, rescue drive, or while the system is charging. The drive status is indicated in the top left of the display. The following table describes the restrictions and their indicators:

Note:

When driving is unrestricted, the HCS does not display an indicator.

Restriction	Indicator	Description
Drive Reduction		Drive speed is reduced due to seat position (reduction based on active drive profile), or certain system faults (Rescue Drive settings used).
Drive Lockout		The system will not drive due to seat position if the system is charging or Mapped I/O is configured to Drive Lockout.

MANDATORY:

Using the latest available OEM Seat configuration automatically sets drive restrictions to ensure safe system operation.

Rescue Drive

Rescue Drive is a configurable drive profile that is automatically enabled based on certain system faults. This includes MODE JACK SUPERVISION and ON/OFF JACK SUPERVISION, depending on how they are configured.

When Rescue Drive is active, the system compares the active drive profile with the Rescue Drive profile. If the active drive profile setting is lower than the Rescue Drive profile setting, then the active drive profile setting is used.

Note:

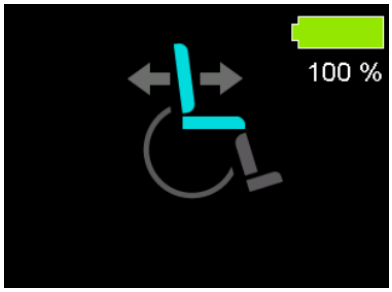
Various menus described in System Parameters contain drive-related parameters.

Seat Profiles

The standard seat screen shows a seat graphic with directional arrows. The actuator(s) of the seat to be controlled are highlighted. When an actuator is moving, the corresponding arrow will indicate the direction of movement. To operate the seat, a forward or reverse command is needed from the active input device. To navigate the different configured seat functions, a left or right command is required from the active input device.

Note:

Standard seat operation is different for a head array input device, as only the left and right inputs are used. See Switch for more information.



Note:

It is not required to be in a seat screen to operate a seat function. It is possible to operate a seat function through the ESM, Mapped I/O, or the Auxiliary menu per configuration. If the ESM or Mapped I/O is used, the system can be configured to operate the seat while driving (SEAT ENABLE WHILE DRIVING).

For information on the seating parameters, see Seat Parameters and Seat Configuration.

Seat Restrictions

The enAble X1 system can restrict seat functions based on a switch condition, inclinometer feedback and actuator feedback. Seat restrictions can be setup to stop movement in either or both directions.

MANDATORY:

Using the latest available OEM Seat Configuration file for cloning ensures proper setup of seat and actuator restrictions. This ensures safe system operation.

Auxiliary and Settings Menu Profiles

The Hand Control Standard and Display Module provide **Auxiliary** and **Settings** menus. These menus are described in the *enAble X1 User Manual*.

The following list describes a few of the relevant parameters:

Parameter	Menu
Show Change Input Device	Enables / disables the **Auxiliary** menu entry **Change Input Device**.
Sleep Power Mode	Enables / disables the **Auxiliary** menu entry **Sleep Power Mode**.
Show In Auxiliary	Enables / disables the **Auxiliary** menu entry **User Functions**.
ECM Enable	Enables / disables the **Auxiliary** menu entry **ECM**.
Settings	Enables / disables the **Settings** menu entry.

Note:

For information on parameters for the Auxiliary and Settings menus, see Hand Control Standard Parameters and Display Module Parameters.

Home Screen And Menu Navigation

The following sections describes the Home screen and menu navigation for the Hand Control Standard and Display Module:

- Home Screen
- Mode Command
- Jack Command
- Standby Select

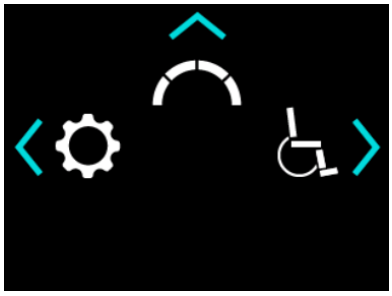
Home Screen

The following sections describe Home screen considerations for the Hand Control Standard and Display Module.

HCS Home Screen

The Hand Control Standard Home screen is available on a configured mapped IO button or Soft key and allows quick access to drive, auxiliary and seat screens. They can be accessed by providing a forward, left, or right command, respectively, from the active input device. The requirements for the icons to appear on the Home screen are:

- Drive: At least one profile in Profile Setup must be configured for Drive 1, 2, 3, or 4.
- Seat: A seat configuration is downloaded to the system, and a seat module is part of the system.
- Auxiliary: The **Auxiliary** menu is always available from the Home screen even if disabled from the Mode function.



Shortcuts to access the Home screen are available from:

- On/Off or Mode Jack Command configured as Home.
- Soft Key assignment

WARNING:

When accessing drive from the Home screen, the first configured drive profile in Profile Setup is always selected. All drive profiles can be configured at any speed, so the first drive profile may not be the slowest.

Startup Mode

By default, the home screen is shown when the system is powered on (USER ENTRY POINT). Other possibilities for startup are:

- Last Used
- 1st Drive Profile
- 2nd Drive Profile
- 3rd Drive Profile

- 4th Drive Profile
- Auxiliary
- Seat

Note:

If USER ENTRY POINT is set to 3rd Drive Profile or 4th Drive Profile and the AC powers on the system, the Home screen will be shown.

Menu Navigation

Navigation in the **Settings** and **Auxiliary** menus is done by joystick input commands, left and right to move through the options, forward and reverse to select and/or make adjustments. Commands to change screen brightness, audio volume and horn volume are always auto repeat commands. All other commands are manual.

DM Home Screen

The DM Home screen allows quick access to drive, seat, settings, and environmental screens. They can be accessed by providing a forward, reverse, left, or right command, respectively, from the active input device. The requirements for the icons to appear on the Home screen are:

- Drive: At least one profile in Profile Setup must be configured for Drive 1, 2, 3, or 4
- Seat: A seat configuration is downloaded to the system and a seat module is part of the system.
- Settings: The SETTINGS parameter is enabled.
- Environmental: Bluetooth mouse, Bluetooth joystick or assistive switch control is enabled.

Shortcuts to access the Home screen are available from anywhere on the system:

- On/Off or Mode Jack Command configured as Home.
- D-Sub (9-pin) Mode on SCIM configured as Home.

If Home is commanded while on the Home screen, the system will go to the last active screen.

WARNING:

When accessing drive from the Home screen, the first configured drive profile in Profile Setup is always selected. All drive profiles can be configured at any speed, so the first drive profile may not be the slowest.

Startup Mode

By default, the Home screen is shown when the system is powered on (USER ENTRY POINT). Other possibilities for startup are:

- Last Used
- 1st Drive Profile
- 2nd Drive Profile
- 3rd Drive Profile
- 4th Drive Profile
- Input Device Selection
- Auxiliary
- Seat

Note:

If USER ENTRY POINT is set to 3rd Drive Profile or 4th Drive Profile and the AC powers on the system, the home screen will be shown.

It can also be configured for the system to boot up to the Input Device Selection Screen (INPUT DEVICE SELECTION), where all configured input devices will appear. Once an input device is selected by performing INPUT DEVICE SELECTION DIRECTION with the preferred input device, then the configured USER ENTRY POINT screen is shown.

List Menu Navigation

Navigation in list menus (Settings, Auxiliary, ECM, etc.) is configurable to three different options with MENU NAVIGATION MODE.

- Manual: Menu commands are generated manually, and not repeated.
- Auto Repeat: The first menu command is generated manually. Thereafter, moving from one menu item to the next is repeated as long as the input command is still active. The timing can be configured using MENU NAVIGATION TIMING.

Note:

Auto Repeat does not work with the DM's 4-directional keys.

- Auto Change: Menu commands are generated automatically without any input command. The timing can be configured using MENU NAVIGATION TIMING.

Note:

If 3-Direction Proportional or 3-Direction Switched is the active input device, there will be no forward or reverse toggle arrows in list menus.

The List Navigation can also be configured to assign a specific navigation command for a valid input. See the Parameters section for information on LIST NAVIGATION FORWARD INPUT, LIST NAVIGATION LEFT INPUT, LIST NAVIGATION REVERSE INPUT, and LIST NAVIGATION RIGHT INPUT.

Note:

If MENU NAVIGATION MODE is set to Auto Change, only Select and Backup commands are active.

Mode Command

The mode command cycles through programmed profiles as defined in Profile Setup. There are multiple ways to generate a mode command:

- HC, DM, AC Mode button
- SCIM D-Sub Mode
- Jack Commands
- Input Device (DEVICE DOUBLE COMMAND)
- Mapped I/O

From the Home screen, a mode command navigates to the first configured drive profile.

Example 1: A mode command from the Home screen navigates to Drive 1. Successive mode commands then navigate to Drive 2, Drive 3, Drive 4, Auxiliary, Seat, etc.:

Table 25. Profile Setup, Mode Example 1

	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6
Mode	Drive 1	Drive 2	Drive 3	Drive 4	Auxiliary	Seat

Example 2: A mode command from the Home screen navigates to Drive 2. Successive mode commands then navigate to Drive 3, Drive 4, Seat, Auxiliary, etc.

	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6
Mode	Auxiliary	Drive 2	Drive 3	Drive 4	Disabled	Seat

WARNING:

When accessing drive from the Home screen, the first configured drive profile in Profile Setup is always selected. All drive profiles can be configured at any speed, so the first drive profile may not be the slowest.

Mode Types

There are other types of mode commands that can be configured through SCIM D-Sub Mode, Jack Commands, and Mapped I/O Support.

- Mode Shortcut: Navigate to the next active profile type.

  Example: A mode shortcut command from the Home screen navigates to Drive 1. Successive mode shortcut commands then navigate to Auxiliary, Seat, Drive 1, etc.

  Table 26. Profile Setup, Mode Shortcut Example

	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6
Mode	Drive 1	Drive 2	Drive 3	Drive 4	Auxiliary	Seat

- Mode Next: Navigate to the next active profile. This is the same effect as a standard mode command.
- Mode Previous: Navigate to the previous active profile. Once the first configured drive profile is reached, it is not possible to go any further.

Profile Change Stop

A mode command can be possible while driving. If PROFILE CHANGE STOP DRIVE is enabled, a mode command always stops driving before the mode command is executed. If PROFILE CHANGE STOP DRIVE is disabled and the next profile is a drive profile, a mode command changes to the next drive profile without stopping unless the system is being switched to or from a latched drive profile. If the next profile is not a drive profile, a mode command will stop driving and the next profile will be selected.

Jack Command

Jack Configuration

Jack commands are highly customizable for both the Mode Jack and On/Off Jack. Each jack can be configured for 1 switch or 2 switch using MODE JACK SWITCH TYPE and ON/OFF JACK SWITCH TYPE.

The Mode Jack can be configured with MODE JACK CONFIGURATION TYPE to use Jack Configuration or Mapped I/O. The On/Off Jack can only be used with Jack Configuration.

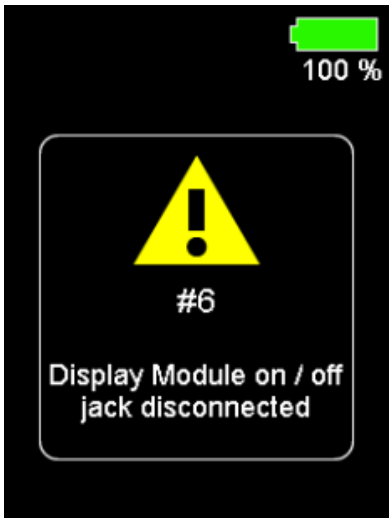
Jack Switch Options / Timing allow for short, long, and double commands for each jack switch when using Jack Configuration (not available for Mapped I/O). The timings for long, and double commands are all configurable and can be taught by using a programming device. The short command is executed once the double command time has elapsed. This allows for up to three different commands per switch.

Jack Supervision

A warning can be displayed if a jack is disconnected by configuring MODE JACK SUPERVISION or ON / OFF JACK SUPERVISION.

By default, both supervisions are disabled.

- Stop: If a switch is disconnected while driving, the system comes to a stop and a warning is shown. No driving is allowed until the switch is reconnected.
- Rescue Mode: If a switch is disconnected while driving, the system enters rescue drive and a warning is shown. The system will remain in rescue drive until the switch is reconnected.
- Warning: If a switch is disconnected while driving, the system continues to drive normally and a warning is shown. the following screenshots show the warning screens for the DM and HCS, respectively:



WARNING:

For the Jack Supervision to work properly, the MODE JACK SWITCH TYPE and ON / OFF JACK SWITCH TYPE must be configured properly.

Jack E-Stop

The system can come to a stop while driving if MODE JACK E-STOP or ON / OFF E-STOP. By default, both E-Stops are off.

- Decel Stop: Activating the jack switch while driving will cause the system to come to a Decel Stop. See Decel Stop for more information on this type of stop.
- Quick Stop: Activating the jack switch while driving will cause the system to come to a Quick Stop. See Quick Stop for more information on this type of stop.

While the system is not driving, the jack switches will still perform their other configured function(s).

Jack Command Options

- Mode: Navigate to the next active profile.
- Mode Shortcut: Navigate to the next active profile type.
- Toggle: Change directional arrow (FWD / REV) in 3-direction driving mode.
- Power Off: System powers off (for On / Off Jack Command only).
- Sleep: System enters Sleep Power Mode.
- Home: Navigate to the home screen.
- Inactive: No functionality.
- Enter Lock: Enter System Lock.
- Mapped I/O Options.

See Mapped I/O for a full list of all Mapped I/O programming options.

Standby Select

Standby Select is available when the DM is connected to the system. Standby Select allows for profile navigation without a mode command. The Standby Select screen is identical to the home screen. If

STANDBY SELECT is enabled and no input command is given for STANDBY SELECT TIMEOUT while on the Home screen or in a drive profile, the system will enter the Standby Select screen.

If the drive icon is selected from the Standby Select screen, a drive profile selection screen is shown. If one of the available drive profiles is not selected within STANDBY SELECT TIMEOUT, the system will return to the Standby Select screen.

To enter Standby Select from a Seat or Auxiliary profile, STANDBY SEAT TIMEOUT and STANDBY AUX TIMEOUT must be enabled. Otherwise, an alternative method to leave those profiles must be available.

Standby Select can be configured independently for each input device configured on the system.

Input Configuration

There are various configuration options for input types. The input signals for drive and seat profiles can be proportional, switch, or pressure controlled. In addition, 3-direction and latch settings are available for proportional and switch inputs. Latch settings are available for pressure control inputs.

There are corresponding drive profiles for different input device types. The User Drive Profiles used by the system depend on the active input device being used. See User Drive Profiles Menu for a full listing.

Drive Profile	Description
Hand Control Profiles	• HC INPUT CONFIGURATION set to Proportional, or 3-Direction Prop (applicable when DM added to system). • HCB INPUT CONFIGURATION set to Proportional.
Switched Head Profiles	SCIM INPUT CONFIGURATION set to 3-Switch Head, 4-Switch Head, 5-Switch Head, or 3-Dir. Prop. Head Switch Op.
Switched Profiles	• HC INPUT CONFIGURATION set to Switch Operation, or 3 Direction Switch op (Applicable when DM added to system). • HCB INPUT CONFIGURATION set to Switch Operation. • SCIM INPUT CONFIGURATION set to Proportional Switch Op., 3-Direction Prop. Switch Op., 2-Switch, 3-Switch, 4-Switch, or 5-Switch. • SINGLE SWITCH OPERATION - 1 Switch Scanner Enable set to Enabled
Mini Proportional Input Profiles	SCIM INPUT CONFIGURATION set to Mini Proportional, or 3-Direction Mini Proportional.
Proportional Input	SCIM INPUT CONFIGURATION set to Proportional, or 3-Direction Proportional.
Proportional Head Profiles	SCIM INPUT CONFIGURATION set to 3-Direction Prop. Head.
Sip & Puff Profiles	SPM INPUT CONFIGURATION set to 2 Pressure or 4 Pressure.
Attendant Control Profiles	Attendant Control input is not adjustable, proportional operation only.

The following sections describe input configuration for inputs:

- Proportional
- Switch
- 3-Direction
- Two Pressure / Four Pressure
- Latched

Proportional

A proportional input is an analog signal, and gives full control of the system when operating in drive and seat profiles since the input is measured in a range of 0 – 100%. The drive and seat speed can be varied with the amount of deflection of a joystick or the amount of pressure on a proportional head device.

Proportional Joystick

A joystick is a common proportional input. Joystick Setup parameters can be adjusted like CENTER DEADBAND, TREMOR SUPPRESSION, THROW, and ASSIGNED DIRECTION in order to achieve the desired control. For a third party proportional device, a calibration of the device may be necessary. If AUTO CENTER ADJUST is Enabled, then the system will automatically detect center and allow safe usage without a proper calibration.

By default:

- A forward command occurs by deflecting the joystick forward (up), past CENTER DEADBAND.
- A reverse command occurs by deflecting the joystick backward (down), past CENTER DEADBAND.
- A right command occurs by deflecting the joystick right, past CENTER DEADBAND.
- A left command occurs by deflecting the joystick left past, CENTER DEADBAND.

See Hand Control Standard Parameters, Hand Control Basic Parameters, and Display Module Parameters for more detailed information related to these parameters.

Switch

A switch input is a digital signal that is either on or off. In a drive or seat profile, the system will begin to achieve the maximum speed with an active input using that drive profile / actuator acceleration rate.

Additional driving parameters can be adjusted while operating in switched, for combined switched commands (e.g., turning left while driving forward). These parameters are SWITCHED TURN DRIVE 1, 2, 3, 4, and SWITCHED TURN TIME. See System Parameters for more information on these parameters.

Proportional Joystick Switch Operation

The Hand Control or a third-party proportional input joystick can be programmed for Switch Operation. When the joystick is deflected past 50% input, a command will be generated. The input command remains active until the joystick is moved below 30%. Because the Joystick Setup CENTER DEADBAND and THROW parameters are still relevant, 50% joystick deflection may not be 50% input command.

For example, consider CENTER DEADBAND 10% and FORWARD THROW 30%. Only 20% forward joystick deflection would be needed to achieve a 50% input command.

Table 27. Joystick Deflection vs. Input Command vs. System Output

Joystick Deflection	Input Command	System Output
0	0	0
5	0	0
10	0	0
15	25	0

Table 27. Joystick Deflection vs. Input Command vs. System Output (continued)

Joystick Deflection	Input Command	System Output
20	50	100
25	75	100
30	100	100

By default:

- A forward command occurs by deflecting the joystick forward (up), past 50% input.
- A reverse command occurs by deflecting the joystick backward (down), past 50% input.
- A right command occurs by deflecting the joystick right, past 50% input.
- A left command occurs by deflecting the joystick left, past 50% input.

For more detailed information related to these parameters, see Hand Control Standard Parameters, Hand Control Basic Parameters, and Display Module Parameters.

Switch Devices

Third party switch devices can be used via the D-Sub connector with different switch input configurations.

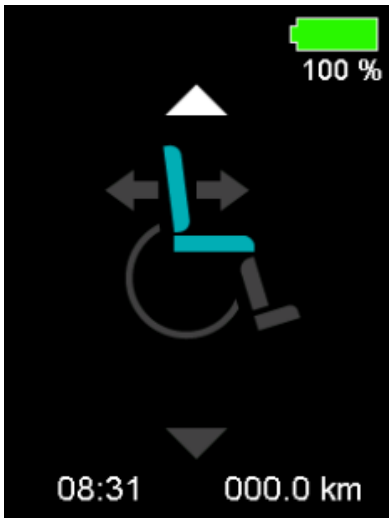
Head Switch Seat Operation and Total Back Angle Head Control

Operating the seat with a head device is different for standard seat operation.

To change the seat function, provide a short left command.

To toggle the seat direction arrow, provide a short right command.

To actuate the seat function in the highlighted direction, provide a long right command.



Note:

If SEAT HEAD LEFT / RIGHT SWAP is set to Yes, the left and right commands above are swapped.

The main difference with a head device is that the back switch needs to be deactivated if the chair gets tilted too far back. When the TOTAL BACK ANGLE HEAD CONTROL is met and a head device is active (3-Switch Head, 4-Switch Head, 5-Switch Head), the back switch becomes disabled, so driving and menu navigation operation changes. A left and right direction arrow then becomes available, in addition to the forward and reverse direction arrow.

When TOTAL BACK ANGLE HEAD CONTROL is met:

To toggle the forward and reverse direction arrow, provide a short right command. To toggle the left and right direction arrow, provide a short left command.

A forward command occurs from a long right switch activation, while the forward direction arrow is highlighted.

A reverse command occurs from a long right switch activation, while the reverse direction arrow is highlighted.

A right command occurs from a long left switch activation, while the right direction arrow is highlighted.

A left command occurs from a long left switch activation, while the left direction arrow is highlighted.

In a confirm screen where only two options are available, the left switch toggles options and the right switch selects the highlighted option.

Normal 3-Switch Head, 4-Switch Head, or 5-Switch Head operation resumes when the measured angle is less than the TOTAL BACK ANGLE HEAD CONTROL.

1-Switch Scanner

All system capabilities are available with a single switch (Mode). To use 1-Switch Scanner, the switch must be connected to the Mode Jack, On/Off Jack, or D-Sub Mode (pin 6). When 1-Switch Scanner is the active input device, the following items are true:

- The D-Sub Mode default is to operate the 1-Switch Scanner, and the configuration of D-Sub Mode is disregarded.
- The Mode Jack default is to operate the 1-Switch Scanner. MODE JACK SWITCH TYPE is treated as 1-Switch. If MODE JACK CONFIGURATION TYPE is set to Mapped I/O, the Mapped I/O configuration is still active.
- The On/Off Jack default is to switch the system on and operate the 1-Switch Scanner. ON / OFF JACK SWITCH TYPE is treated as 1-Switch, and Jack configurations are disregarded.
- HCS Shortcut buttons are inactive.
- The DM's Mode Button and 4-Directional Keypad are active.

1-Switch Power On / Off

The system can be powered on with 1-Switch Scanner if it is connected to the On / Off Jack.

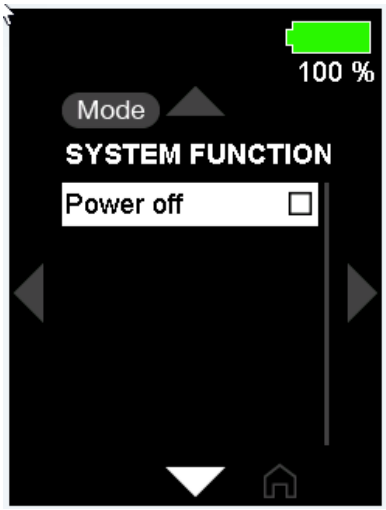
Note:

If INPUT DEVICE SELECTION is set to Input Device Selection Screen, 1-Switch Scanner cannot be activated directly from power on.

See Powering On/Off for alternative methods of powering the system.

1-Switch Operation

When 1-Switch Scanner is active, the available menu choices are cycled continuously on the display. SCAN RATE determines how fast the scanner will cycle the different options.

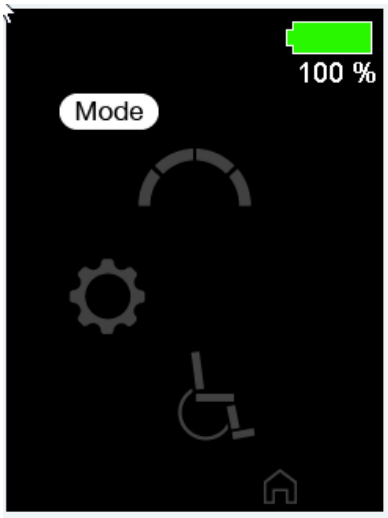


Home

On the Home screen, the scanner highlights the available profiles, Mode, and Home options.

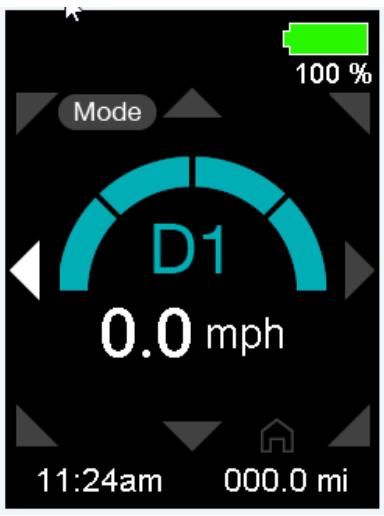
Note:

If MODE SCAN OPTION is Off, the Mode option is no longer available in any screen. An alternative Mode method must be available for standard operation.



Drive

In a Drive profile, arrows are highlighted to select the direction of the drive. Mode and Home options are still available. 4-Direction and 8-Direction options are programmable per drive profile.



Seat

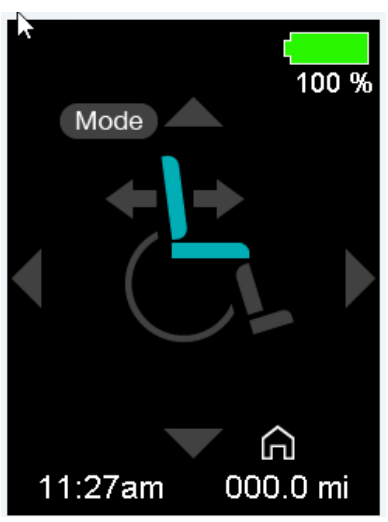
If MENU NAVIGATION MODE is Manual or Auto Repeat, left and right arrows will be highlighted to navigate different available seat functions. The seat arrows will operate the function in the highlighted direction.

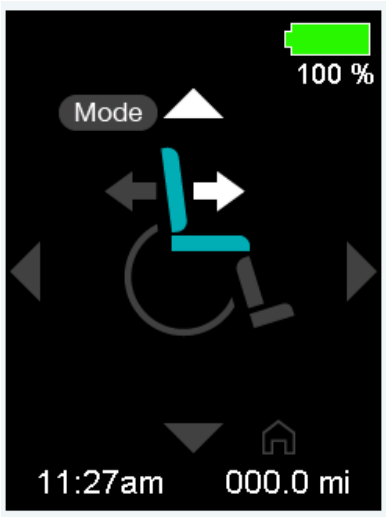
If MENU NAVIGATION MODE is Auto Change, the available seat functions will cycle automatically and a seat arrow will be highlighted. To toggle direction, press the 1-Switch on the desired actuator and the opposite-seat arrow will highlight. Another 1-Switch command will operate the seat in the new highlighted direction.

If a seat is running latched in the seat profile, scanning stops. Another 1-Switch command stops actuator movement, and then scanning resumes.

Note:

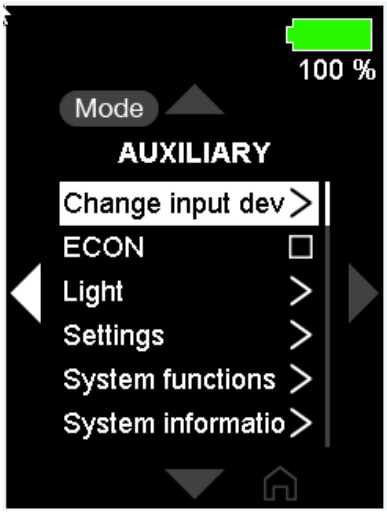
While 1-Switch Scanner is active and SEAT NAVIGATION is advanced, the system operates as if it is set to standard. If the active input device is changed from 1-Switch Scanner, advanced seat will then be active, as shown below.





Auxiliary / Settings Menu

In the **Auxiliary** and **Settings** menus, arrows are highlighted to select different menu entries. Mode and Home options are available.



Note:

If MENU NAVIGATION MODE is Auto Change for 1-Switch Scanner, then the arrows are not displayed. Mode and Home options become available within the Auxiliary list menu.

Scan Order

Each drive profile can have a preset or custom scan order.

For example, consider the 4 Direction Clockwise preset in Profile 2:

Item	Profile 2
Item 1	Forward
Item 2	Right
Item 3	Left
Item 4	Step 2
Item 5	None
Item 6	None
Item 7	None
Item 8	None
Item 9	None
Item 10	None

The preset scan order can be selected by configuring PROFILE 1 ASSIGN SCAN ORDER, PROFILE 2 ASSIGN SCAN ORDER, PROFILE 3 ASSIGN SCAN ORDER, and PROFILE 4 ASSIGN SCAN ORDER. See 1-Switch Scanner Parameters for a complete listing.

The Scan Order cannot be changed for all other profiles and operates in the clockwise direction (e.g., Home), or from left to right (e.g., Set Time function).

Configuration

There are other important parameters related to 1-Switch Scanner, such as E-STOP FOR LATCH and 1-SWITCH TIMEOUT. See 1-Switch Scanner Parameters.

2-Switch

With 2-Switch control (Left, Right), a Mode button is optional. DEVICE DOUBLE COMMAND can be programmed Enable Left or Enable Right to perform a Mode operation.

A forward command occurs from a short right, then long right switch activation. A reverse command occurs from a short left, then long left switch activation.

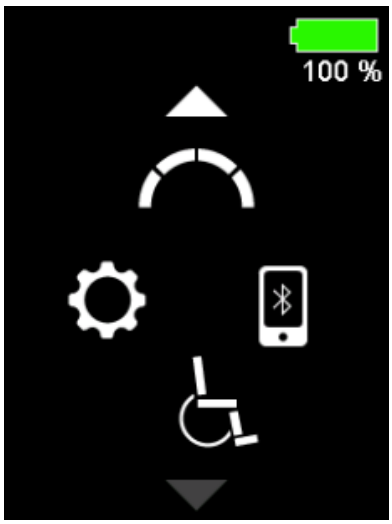
A right command occurs from a long right switch activation. A left command occurs from a long left switch activation.

Any simultaneous switch combination while driving 2-Switch will lead to a drive inhibit, until both switches are released.

3-Switch / 3-Switch Head

With 3-Switch control (Forward, Left, Right), a Mode button is optional. DEVICE DOUBLE COMMAND can be programmed Enable Left or Enable Right to perform a Mode operation.

Forward and reverse arrows are available on Home, Drive, and Auxiliary screens. To toggle the direction arrow, provide a short forward command.



A forward command occurs from a long forward switch activation, while the forward direction arrow is highlighted.

A reverse command occurs from a long forward switch activation, while the reverse direction arrow is highlighted.

A right command occurs from a right switch activation. A left command occurs from a left switch activation.

A forward and right switch or forward and left switch combination are possible while driving (e.g., to drive forward and turn right simultaneously). A left and right switch combination while driving will lead to a drive inhibit, until both switches are released.

3- Switch Head

A 3-Switch Head device has a slightly different configuration (Back, Left, Right), with a back switch replacing the forward switch on 3-Switch device.

See Head Switch Seat Operation and Total Back Angle Head Control for operation with a head device when the TOTAL BACK ANGLE HEAD CONTROL is met.

4-Switch / 4-Switch Head

With 4-Switch control (Forward, Reverse, Left, Right), a Mode button is optional. DEVICE DOUBLE COMMAND can be programmed Enable Left or Enable Right to perform a Mode operation.

A forward command occurs from a forward switch activation. A reverse command occurs from a reverse switch activation. A right command occurs from a right switch activation. A left command occurs from a left switch activation.

A forward or reverse and right switch, or forward or reverse and left switch combination are possible while driving (e.g., to drive forward and turn right simultaneously). A left and right or forward and reverse switch combination while driving will lead to a drive inhibit, until all switches are released.

4-Switch Head

A 4-Switch Head device has the same operation as a 4-Switch device.

See Head Switch Seat Operation and Total Back Angle Head Control for operation with a head device when the TOTAL BACK ANGLE HEAD CONTROL is met.

5-Switch / 5-Switch Head

With 5-Switch control (Forward, Reverse, Left, Right, Mode), a Mode button is included. DEVICE DOUBLE COMMAND can still be programmed Enable Left or Enable Right to perform a Mode operation.

A forward command occurs from a forward switch activation. A reverse command occurs from a reverse switch activation. A right command occurs from a right switch activation. A left command occurs from a left switch activation.

A mode command occurs from a mode switch activation.

A forward or reverse and right switch, or forward or reverse and left switch combination are possible while driving (e.g., to drive forward and turn right simultaneously). A left and right or forward and reverse switch combination while driving will lead to a drive inhibit, until all switches are released.

5-Switch Head

A 5-Switch Head device has the same operation as a 5-Switch device.

See Head Switch Seat Operation and Total Back Angle Head Control for operation with a head device when the TOTAL BACK ANGLE HEAD CONTROL is met.

3-Direction

3-Direction operation can be proportional or switched, and is similar to 3-Switch operation. Reverse, Right, and Left inputs are used.

To toggle the direction arrow, provide a short reverse command.

A forward command occurs by deflecting the joystick backward (down), while the forward direction arrow is highlighted.

A reverse command occurs by deflecting the joystick backward (down), while the reverse direction arrow is highlighted.

A right command occurs by deflecting the joystick right.

A left command occurs by deflecting the joystick left.

Toggle Settings

3-Direction Arrow Toggle Settings are available to define the input to create a toggle or select command. A profile can enable or disable toggle commands. If toggling is disabled in any profile, another method of toggling is necessary (e.g. through Jack Commands).

For parameter descriptions regarding 3-Direction Arrow Toggle Settings, see HCS: 3-Direction Arrow Toggle Menu and Specialty Control Input Module Parameters.

Two Pressure / Four Pressure

The Sip & Puff module allows inputs to the system through a straw, by sipping and puffing. When the Sip & Puff is being used, a pressure gauge is shown on the left of the display.

The two different input configurations are detailed below.

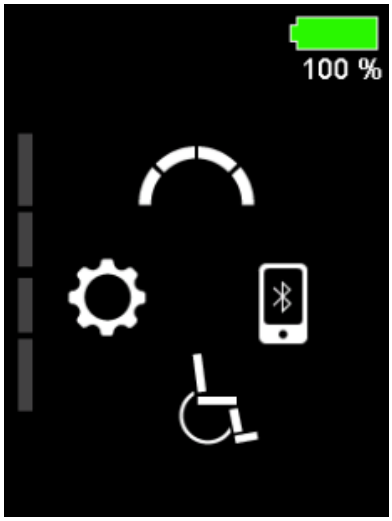
Two Pressure

Inputs are made with a continuous sip or puff, and a short then continuous sip or puff. The forward, reverse, right, and left direction assignment can be customized.

By default:

- A forward command occurs from a short, then continuous puff.
- A reverse command occurs from a short, then continuous sip.

- A right command occurs from a continuous puff.
- A left command occurs from a continuous sip.



Four Pressure

Inputs are made with a soft sip, soft puff, hard sip, or hard puff. The forward, reverse, right, and left direction assignment can be customized.

By default:

- A forward command occurs from a hard puff.
- A reverse command occurs from a hard sip.
- A right command occurs from a soft puff.
- A left command occurs from a soft sip.

A Quick Setup function is available with a programming device to quickly configure sip and puff pressure levels. See the Sip & Puff Module Parameters for all related parameters to Pressure Fine Adjustment and Pressure Direction Assignment.

Latched

Latching is a feature that allows drive and seat operation for LATCH TIMEOUT period, without keeping the original input active. A latch indication is shown on the display when it is programmed for a drive profile or seat function. When latch is inactive, the indication bar is empty.

When latch is active, the indication bar slowly depletes until the latch time is expired.

While a drive or seat function is latched, there are two simple ways to stop the latch before the LATCH TIMEOUT expires:

- A mode command will stop the latch and the system will navigate to the next profile.
- A command in the opposite direction of travel will stop the latch and stay on the current profile (e.g., driving forward latch, provide a reverse command to stop).

While drive is latched, a direction command (right or left) will refresh the latch to LATCH TIMEOUT.

Note:

If LATCH TIMEOUT DISABLE is set to Yes, the drive or seat operation will not stop while latched unless a stop command is given.

MANDATORY:

LATCH TIMEOUT DISABLE should not be set to Yes for normal operation.

WARNING:

Do not enable any latch mode if the mode switch is not easily accessible for the user to stop the chair in any situation. An emergency stop method is highly recommended for any latch setting.

There are three different types of latch for drive operation, detailed in the table below. See User Drive Profiles Menu for drive latch settings and Seat Parameters for seat latch settings.

Type of Latch	Description
Cruise	Cruise can be configured for drive LATCH FORWARD. Speed continuously ramps up while the forward command is active, and will maintain the speed achieved when the forward command is released.
3-Step	3-Step can be configured for drive LATCH FORWARD. Speed increases by one step (33.3% of the configured drive profile) with each forward command over 50%, to a total of three steps.
1-Step	1-Step can be configured for drive LATCH FORWARD and LATCH REVERSE. Speed increases to the maximum drive profile setting with one forward or reverse command over 50%.

Speed / Step Reduce

When stopping or slowing a latch drive, there are three options for LATCH DECEL / BRAKING: Decel Stop, Quick Stop, or Speed / Step Reduce. The following table describes the behavior if Speed / Step Reduce is selected for the various latch driving methods.

Latch Driving Method	Behavior
Cruise	Speed continuously ramps down while the reverse command is active, and will maintain the speed achieved when the reverse command is released.
3-Step	Speed decreases by one step (33.3% of the configured drive profile) with each reverse command over 50%.
1-Step	Speed decreases to zero with one forward or reverse command over 50%.

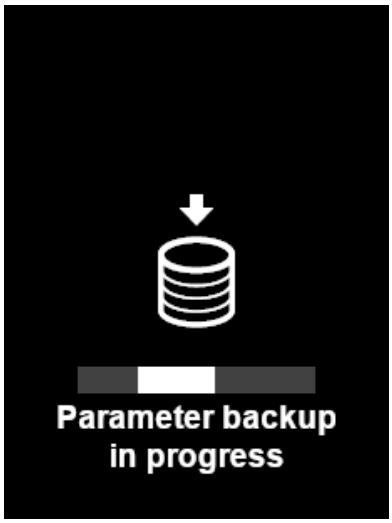
Configuration Management

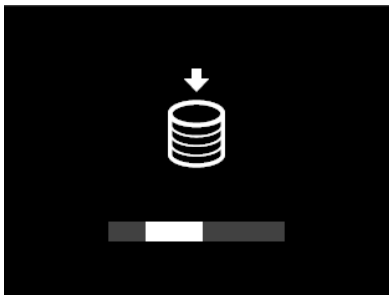
The Primary Module stores the system configuration internally and is the primary display. If a module in the system needs to be replaced, the configuration will automatically transfer to the newly installed module. If a Display Module is part of a system (with or without a Hand Control), that is the Primary Module. If there is no Display Module then the Hand Control would be the Primary Module.

Backup and Restore Process

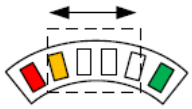
Backup

A Parameter Backup occurs when the system is powering off, if the configuration has been changed. While the configuration is stored in the Primary Module, the backup saves a copy to the Powerbase. The following images show the DM and HCS screens, respectively, during Parameter Backup.





The Hand Control Basic uses the BDI LEDs to indicate that Parameter Backup is active. During Parameter Backup, the left red and right green LEDs are steadily on while the four middle LEDs sequentially blink. The following image represents the BDI LEDs during Parameter Backup:

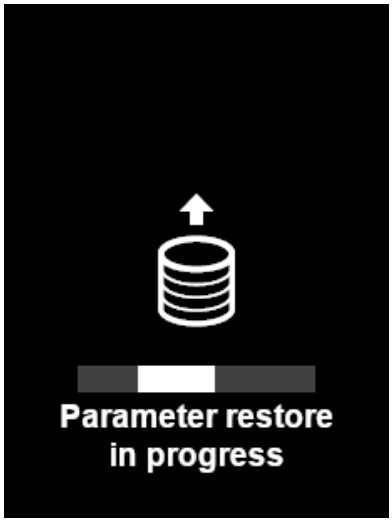


When Parameter Backup is finished, all LEDs are turned off and the system powers down.

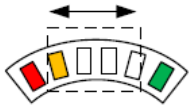
Restore

A Parameter Restore occurs when the system is powering on, if a different Powerbase or Primary Module module is installed. If the Powerbase has a backup configuration, the Parameter Restore will use that. The next power off initiates a Parameter Backup, to ensure the configuration is the same in both the Powerbase and Primary Module.

If the Powerbase has no backup, a Parameter Restore will not occur. Instead, on the next power off the Primary Module will backup its configuration to the Powerbase. The following images show the DM and HCS screens, respectively, during Parameter Restore.



The Hand Control Basic uses the BDI LEDs to indicate that Parameter Restore is active. During Parameter Restore, the left red and right green LEDs are steadily on while the four middle LEDs sequentially blink. The following image represents the BDI LEDs during Parameter Restore:



When Parameter Backup is finished, the BDI LEDs indicate the battery state-of-charge.

Erasing Powerbase Backup

The Powerbase backup can be erased with the ERASE POWERBASE BACKUP function, using any programming device. If this function is used, the first power off of the system will not execute a parameter backup. A Powerbase without a backup can be installed on any system, without overwriting the new system's configuration.

Bluetooth Capabilities

Bluetooth capabilities outside of programming are available with the Hand Control Standard, Hand Control Basic, or the Display Module. The enAble X1 system has Bluetooth functionality to act as a mouse, gaming joystick, or Assistive Switch Control with Apple iOS devices.

To use these features, MOUSE, JOYSTICK, and ASSISTIVE SWITCH CONTROL must be enabled in programming. Otherwise, these Bluetooth connections are not possible. Pairing with Mouse / Joystick will automatically provide pairing for programming. Be aware that pairing to programming first may mean that Mouse / Joystick pairing will not work. To resolve this, delete the Programming pairing and add the Joystick or Mouse pairing.

Important:

For information on the screens and steps for the Bluetooth functionality, see the *enAble X1 User Manual*.

The following sections describe considerations for the enAble X1 Bluetooth functionality that are not described in the *enAble X1 User Manual*.

Store and Clear Bluetooth Connections

Once a Bluetooth connection has been established, the pairing is automatically stored for ease of reconnecting to the previous device. Up to eight connections can be stored for Mouse and Assistive Switch Control.

The saved connections can be deleted by using the CLEAR BLUETOOTH CONNECTIONS function from a programming device, or through the steps described in the *enAble X1 User Manual*.

Joystick

The Joystick profile allows the input device to become a game controller for PC applications. This feature can be utilized with 3rd party PC software to configure the joystick and two buttons as different inputs, depending on the game that is played.

The two buttons can be operated by programming Mapped I/O or ESM for Mouse clicks. See Bluetooth Parameters for programming options using the Joystick profile.

Mouse / Apple Mouse

There are two screens associated with the mouse. Configuring MOUSE CLICKS allows many different possibilities for navigating between the two screens and operating the mouse. All options are covered in detail, see Bluetooth Parameters. Additionally, the Mouse Settings can be accessed on the DM by navigating to **Auxiliary > Bluetooth Operation > Mouse Settings**.

The Mouse can be used with any input device. For 3-direction control, the toggle arrows are shown. Compatible operating systems for the mouse are:

- Windows XP
- Windows Vista
- Windows 7 and above
- MacOS
- IOS 14.2 and above

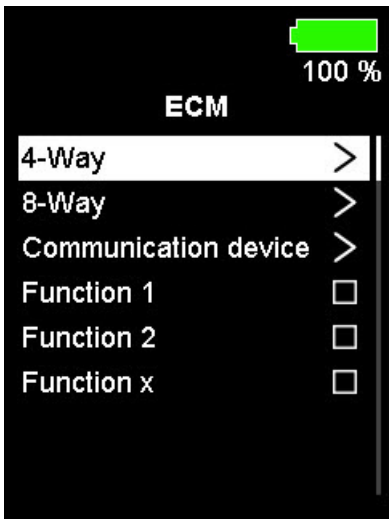
The ESM or Mapped I/O can be programmed for mouse click shortcuts, so the input device would only need to move the mouse.

ECM Operation

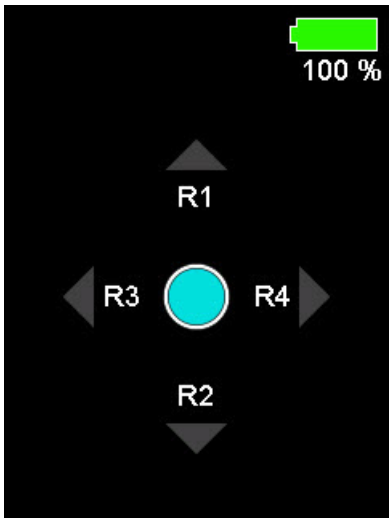
The Environmental Control Module (ECM) is used to operate external devices that can be controlled from Relay switch outputs. The ECM must be used in conjunction with a Display Module (DM). The ECM can be accessed by navigating to the ECM option in the Auxiliary Menu as shown below. (ECM functions can also be set on the ESM or by mapped I/O). The ECM has four types of output, which are described in the following sections.

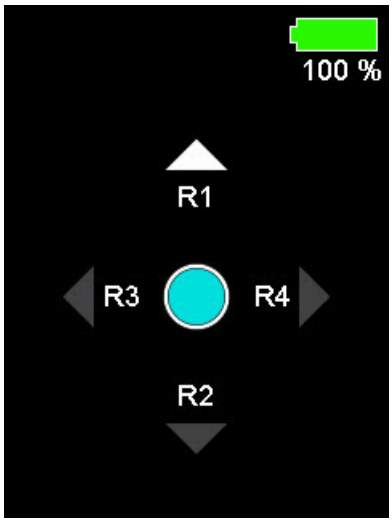
ECM 4-Way Menu

Enter the **ECM** menu and choose **4-Way**.



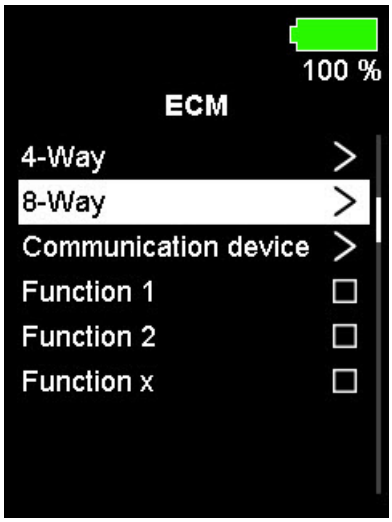
Use a right command to select 4-Way operation. The input device can then be used in the forward, reverse, left and right directions to operate the relative relays as shown below.



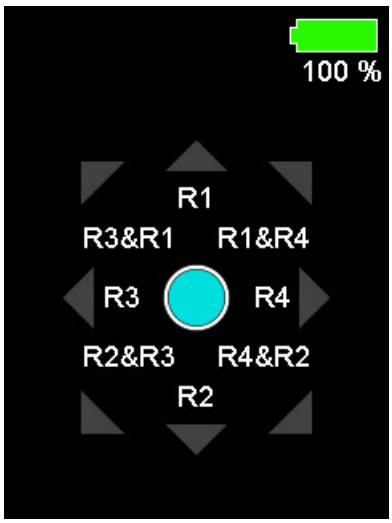


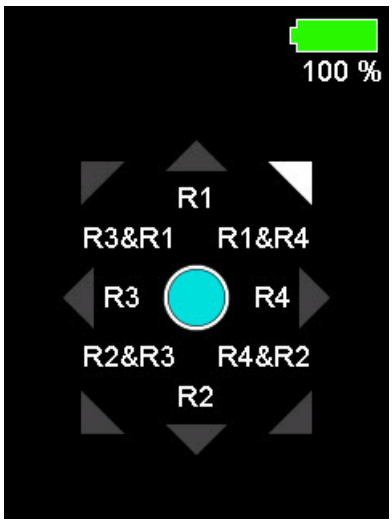
ECM 8-Way Menu

Enter the **ECM** menu and choose **8-Way**.



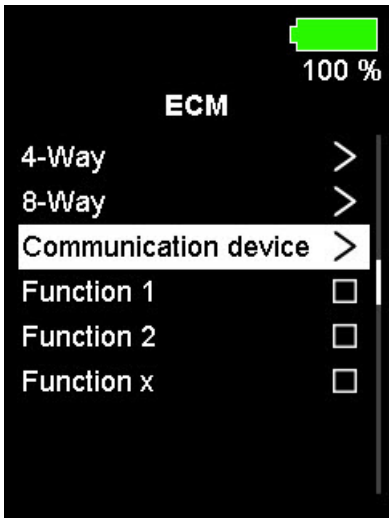
Use a right command to select 8-Way operation. The input device can then be used in the forward, reverse, left and right and all diagonal directions to operate the relative relays as shown below.



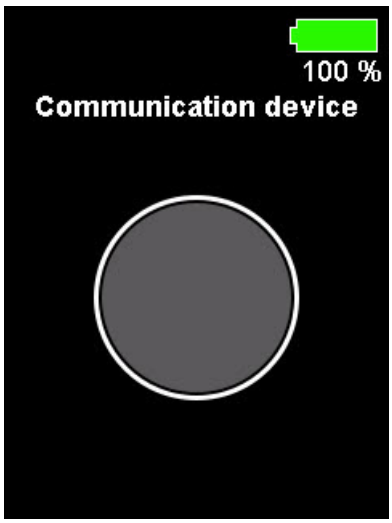


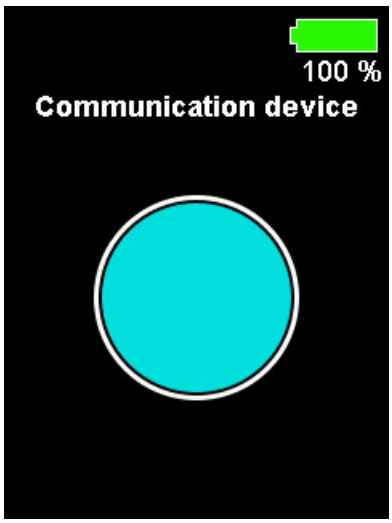
ECM Communication Device Menu

Enter the **ECM** menu and choose **Communication device**.



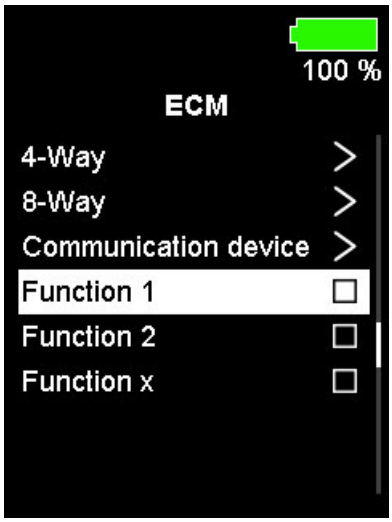
Use a right command to select **Communication device**. The input device can then be used to operate any communication device in scanning mode with a single switch input by operating the input device in the selected direction (right by default). The relay output of choice can be set in the ECM programming section.

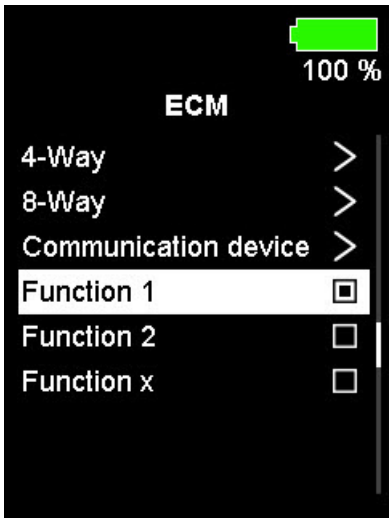




ECM Function Menu

Enter the **ECM** menu and select the Function (Relay output) you wish to operate. The function is operated by giving an input device command in the selected direction (right by default). Multiple functions can be programmed with either single or multiple relay outputs.



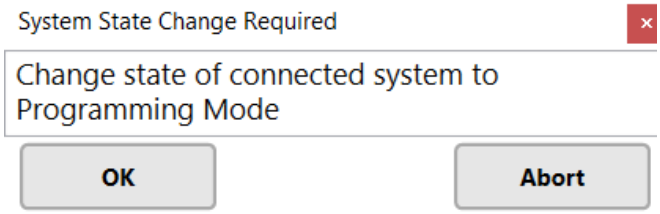


5 — Programming

The following topics how to program the enAble X1 system. The topics describe the system configuration states and the system parameters.

System Configuration State

During programming, some parameter adjustments result in a system state change. The system state will be shown on the main display via a “traffic light” indicator or splash screen. Before a system state change occurs, a programming device will display a warning to accept the state change or abort.



Note:

The warning will not be displayed when a configuration is being loaded and the system automatically enters the Power Cycle Required state.

WARNING:

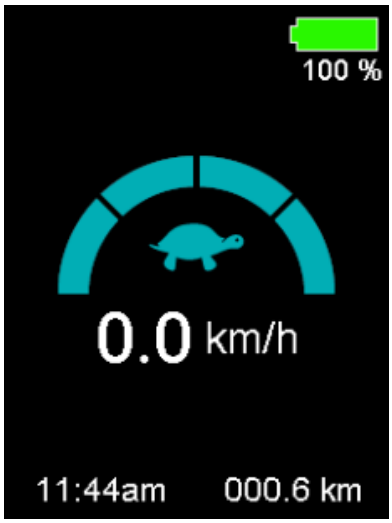
Only program the system in a safe environment, since some configuration states limit system operation.

The system can enter the following configuration states:

- System Ready
- Programming Mode
- Power Cycle Required
- Drive Inhibited
- Output Inhibited

System Ready State

In the System Ready configuration state, normal operation of the system can be expected.



The ECON programming device also shows the configuration state.

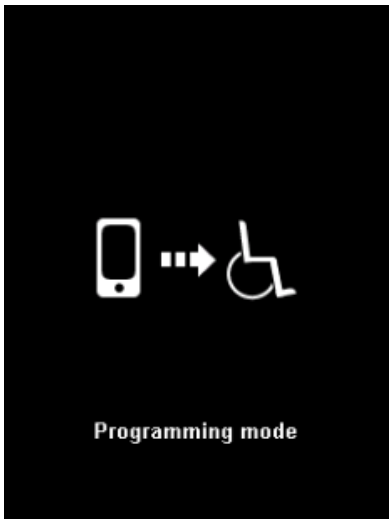
System Ready Indication, Hand Control Basic

The Drive Profile LEDs of the Hand Control Basic indicate the System Ready state:

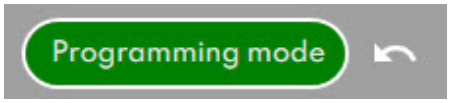
Programming Mode State

In the Programming Mode state, the system is no longer operable. Operability is restored when the system returns to the System Ready state.

When the system is in Programming Mode, the main display uses a splash screen to show the state.



The ECON programming device also shows the configuration state.



To exit Programming Mode, use the connected programming device to return to the System Ready state.

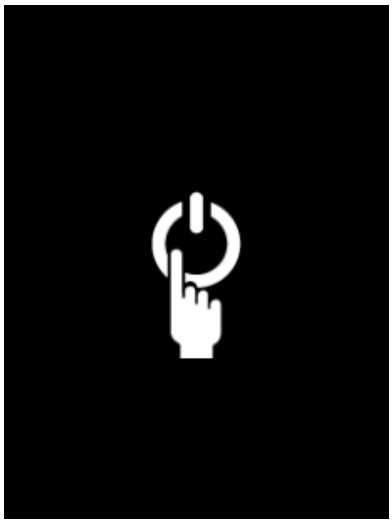
Programming Mode Indication, Hand Control Basic

To indicate that the system is in Programming Mode, the Hand Control Basic's BDI LEDs simultaneously flash with a frequency of 0.5Hz.

Power Cycle Required State

When the system is in the Power Cycle Required state, the programming device can remain connected and other parameter adjustments can be made.

The system indicates the Power Cycle Required state with the following indicator:



The ECON programming device also shows the configuration state.

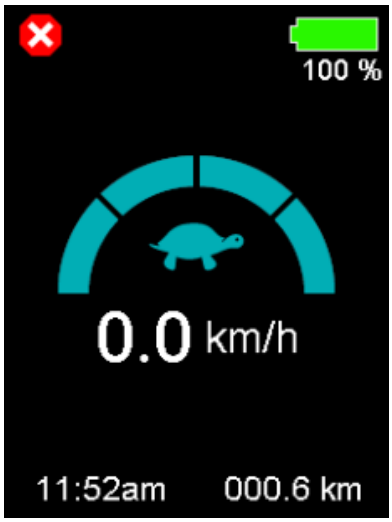
When all desired changes are made, power cycle the system to revert to the System Ready state.

Power Cycle Required Indication, Hand Control Basic

To indicate that the system is in the Power Cycle Required state, the BDI LEDs of the Hand Control Basic flash simultaneously with a frequency of 2Hz.

Drive Inhibited State

The Drive Inhibit state occurs when running certain functions, such as ASSIGN DIRECTIONS or TEACH DOUBLE COMMAND. The Drive Inhibit state disables operating the system with an input device until the function has finished running. Note the status indicator, , in the top left of the main display.



The ECON programming device also shows the configuration state.

Once the function has finished running or has been aborted, the system will automatically revert to the System Ready state.

Output Inhibited

The Output Inhibited state occurs when running certain functions, such as ASSIGN DIRECTIONS or TEACH DOUBLE COMMAND. Output Inhibited disables operating the system with the input device until the function has finished running. The Drive Profile LEDs of the Hand Control Basic indicate the Output Inhibited state:

The ECON programming device also shows the configuration state.

Once the function has finished running or has been aborted, the system will automatically revert to the System Ready state.

Parameters

The enAble X1 system has a number of parameters that can be programmed using a Curtis ECON programmer. The programmable parameters allow the systems performance and features to be customized to fit the needs of specific applications. The parameters are grouped into menus, which are described in the following sections.

Note:

Curtis Instruments will have full Factory and Developer programming access to all generic enAble X1 devices.

User Drive Profiles Menu

The user drive profiles can be customized for each input device type. Customization can make it is easy to switch between different device types in order to have a comfortable and safe drive.

MANDATORY:

Make sure that a system user can safely operate after adjusting drive profile parameters.

WARNING:

The minimum settings are intended to cover all conditions that a system user may encounter.

Note:

It is recommended to use low speed drive settings when using a specialty input device.

Parameter	Range	Description
Profile Label Type		Defines how the drive profile is shown on the system display, as number, text, icon or symbol. One of these options must be selected. The number displays as D1 to D4. 'Text, Icon and Symbol' can be assigned with the parameters 'Text & Icon' and 'Symbol'.

Parameter	Range	Description
Text & Icon		Defines what profile indication is shown on the system display if either 'Text' or 'Icon' is configured under the parameter 'Profile Label Type'. The following list is available: 'Indoor Slow, Indoor Moderate, Outdoor Moderate, Outdoor Fast, School, Work, Ramp, Sport'.
Symbol		Defines what profile indication is shown on the system display if parameter 'Profile Label Type' is set to 'Symbol'. The following symbols are available: 'Green Circle, Purple Pentagon, White Square, Red Triangle, Blue Cross, Yellow Star'.
Fwd Max Speed	5 – 100 %	Defines the speed limit of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its maximum position and when full forward input is applied. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, the achievable speed is linearly adjusted between this parameter and the parameter 'Fwd Min Speed'.
Fwd Min Speed	5 – 100 %	Defines the speed limit of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its minimum position and a full forward input is applied. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, the achievable speed is linearly adjusted between this parameter and the parameter 'Fwd Max Speed'.
Fwd Max Accel	5 – 100 %	Defines the forward acceleration of the wheelchair when the "Speed Knob"/"User Speed Adjust" is at its maximum position. A higher value represents a shorter acceleration time and a faster start. High acceleration values provide abrupt acceleration and should only be used under special circumstances. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, acceleration is linearly adjusted between this parameter and 'Fwd Min Accel'.
Fwd Min Accel	5 – 100 %	Defines the forward acceleration of the wheelchair when the 'Speed Knob' / 'User Speed Adjust' is at its minimum position. A higher value represents a shorter acceleration time and a faster start. High acceleration values provide abrupt acceleration and should only be used under special circumstances. When the 'Speed Knob'/'User Speed Adjust' is between its min. and max. position, acceleration is linearly adjusted between this parameter and 'Fwd Max Accel'.

Parameter	Range	Description
Fwd Max Decel	5 – 100 %	Defines the forward deceleration of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its maximum position. A higher value represents a shorter deceleration time and a faster stop. High deceleration values provide abrupt deceleration and should only be used under special circumstances. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, deceleration is linearly scaled between this parameter and 'Fwd Min Decel'.
Fwd Min Decel	5 – 100 %	Defines the forward deceleration of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its minimum position. A higher value represents a shorter deceleration time and a faster stop. High deceleration values provide abrupt decelerations and should only be used under special circumstances. When the "Speed Knob"/"User Speed Adjust" is between its min. and max. position, then the deceleration is linearly adjusted between this parameter and 'Fwd Max Decel'.
Rev Max Speed	5 – 100 %	Defines the speed limit of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its maximum position and full reverse input is applied. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, the achievable speed is linearly adjusted between this parameter and 'Rev Min Speed'.
Rev Min Speed	5 – 100 %	Defines the speed limit of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its minimum position and when full reverse input is applied. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, then the achievable speed is linearly adjusted between this parameter and the 'Rev Max Speed' parameter.
Rev Max Accel	5 – 100 %	Defines the reverse acceleration of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its maximum position. A higher value represents a shorter acceleration time and a faster start. High acceleration values provide abrupt acceleration and should only be used under special circumstances. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, acceleration is linearly adjusted between this parameter and 'Rev Min Accel'.
Rev Min Accel	5 – 100 %	Defines the reverse acceleration of the wheelchair when the "Speed Knob" / "User Speed Adjust" is at its minimum position. A higher value represents a shorter acceleration time and a faster start. High acceleration values provide abrupt acceleration and should only be used under special circumstances. When the "Speed Knob" / "User Speed Adjust" is between its min. and max. position, then the acceleration is linearly adjusted between this parameter and 'Rev Max Accel'.

Parameter	Range	Description
Rev Max Decel	5 – 100 %	Defines the reverse deceleration of the wheelchair when the “Speed Knob” / “User Speed Adjust” is at its maximum position. A higher value represents a shorter deceleration time and a faster stop. High deceleration values provide abrupt deceleration and should only be used under special circumstances. When the “Speed Knob” / “User Speed Adjust” is between its min. and max. position, deceleration is linearly adjusted between this parameter and ‘Rev Min Decel.’
Rev Min Decel	5 – 100 %	Defines the reverse deceleration of the wheelchair when the “Speed Knob” / “User Speed Adjust” is at its minimum position. A higher value represents a shorter deceleration time and a faster stop. High deceleration values provide abrupt decelerations and should only be used under special circumstances. When the “Speed Knob” / “User Speed Adjust” is between its min. and max. position, deceleration is linearly adjusted between this parameter and ‘Rev Max Decel. ‘
Turn Min Speed	5 – 100 %	Defines the turning speed limit of the wheelchair when the “Speed Knob” / “User Speed Adjust” is at its minimum position and a full left or right input is applied. When the “Speed Knob” / “User Speed Adjust” is between its min. and max. position, the achievable speed is linearly adjusted between this parameter and the ‘Turn Max Speed’ parameter.
Turn Max Accel	5 – 100 %	Defines the turning acceleration of the wheelchair when the “Speed Knob” / “User Speed Adjust” is at its maximum position. A higher value represents a shorter turning acceleration time and a faster direction response. High turn acceleration values provide abrupt direction changes and should only be used under special circumstances. When the “Speed Knob” / “User Speed Adjust” is between its min. and max. position, acceleration is linearly adjusted between this parameter and ‘Turn Min Accel’.
Turn Min Accel	5 – 100 %	Defines the turning acceleration of the wheelchair when the “Speed Knob” / “User Speed Adjust” is at its minimum position. A higher value represents a shorter turning acceleration time and a faster direction response. High turn acceleration values provide abrupt direction changes and should only be used under special circumstances. When the “Speed Knob” / “User Speed Adjust” is between its min. and max. position, acceleration is linearly adjusted between this parameter and ‘Turn Max Accel’.

Parameter	Range	Description
Turn Max Decel	5 – 100 %	Defines the turning deceleration of the wheelchair when the “Speed Knob” / “User Speed Adjust” is at its maximum position. A higher value represents a shorter turning deceleration time and a faster direction response. High turn deceleration values provide abrupt direction changes and should only be used under special circumstances. When the“Speed Knob” / “User Speed Adjust” is between its min. and max. position, deceleration is linearly adjusted between this parameter and ‘Turn Min Decel.’
Turn Min Decel	5 – 100 %	Defines the turning deceleration of the wheelchair when the “Speed Knob” / “User Speed Adjust” is at its minimum position. A higher value represents a shorter turning deceleration time and a faster direction response. High turn deceleration values provide abrupt direction changes and should only be used under special circumstances. When the“Speed Knob” / “User Speed Adjust” is between its min. and max. position, deceleration is linearly adjusted between this parameter and ‘Turn Max Decel.’
Soft Start Fwd / Rev	0 – 5000 ms	Delay in time to smooth fwd / rev acceleration ramp
Soft Start Turn	0 – 1000 ms	Delay in time to smooth turn acceleration ramp
Power	20 – 100 %	Limits the system drive torque output. The power limit is usually reduced for wheelchair users who may have cognitive disabilities which may result in unintentionally driving into surrounding obstacles. Reducing the power limit also reduces the ability of the wheelchair to cross over obstacles and to maneuver in certain situations under higher load. Lower power limits are normally used for indoor operation. After setting this parameter, please ensure that the wheelchair performs as required in the given user environment (slopes, obstacles, curbs).

Parameter	Range	Description
Latch Forward (Only available with the DM connected)		**WARNING:** Do not enable any latch mode if the mode switch is not easily accessible for the user to stop the chair in any situation. An emergency stop method is highly recommended for any latch setting! 'Cruise' latch: Speed continuously ramps up until the desired speed is reached and will hold the speed reached when releasing the forward command. While driving latched, any deviation below the actual speed will have no influence. Deceleration and stop behavior is governed by parameter setting 'Latch Decel / Braking'. '3-Step' latch: Latch command is active on forward command over 50% of the input device. If the chair is not driving latched, a command below 50% will drive without latch. Speed commands are limited to 33% of max. forward speed to avoid a potential deceleration to the first step from 49% speed down to 33% speed. If the chair is driving latched, a command below 50% will not have any impact. Latch will increase one step with each successive forward command. Deceleration and stop behavior is governed by parameter setting 'Latch Decel / Braking'. '1-Step' latch: Latch command is active on forward command over 50% of the input device. If the chair is not driving latched, a command below 50% will drive without latch. If the chair is driving latched, a command below 50% will not have any impact. Stop behavior is governed by parameter setting 'Latch Decel / Braking. ' Latch with '1-Switch': If 'Latch Forward' is configured, and a forward-right or forward-left command is given, then no forward command is executed but a 50% direction command of the actual drive profile settings. If 'Latch Forward' is configured, any reverse command (reverse, reverse-right, reverse-left) brings the unit to a stop according to parameter setting 'Latch Decel / Braking'. If 'Cruise' latch is set, the unit will not accelerate further once cruise speed is set. **Note:** If the input device is held after the unit has stopped, no command will be generated. To move in reverse direction, a new command must be given.

Parameter	Range	Description
Latch Decel / Braking Forward (Only available with the DM connected)		'Decel Stop': When a reverse command over 50% is given, the chair will come to a soft stop. Latch will be canceled and the chair stops with the drive profile 'Decel' setting. 'Quick Stop': When a reverse command over 50% is given, the chair will perform a quick stop. 'Speed / Step Reduce', different behaviors for: 'Cruise' latch: If a deceleration is required, a reverse command over 50% must be given. Chair will keep the speed once the reverse command is released. A stop can be executed by giving a permanent reverse command over 50%. The chair will then come to a soft stop with the drive profile 'Decel' setting. '3-Step' latch: If a reverse command over 50% is given (reverse, reverse-right, reverse-left), the chair has to decelerate to the next lower step. If the command is released while the speed has already passed, the next lower step chair decelerates to the next step below. Each reverse command over 50% has to step down one step, regardless of the actual speed. A stop can be executed by giving a permanent reverse command over 50%. '1-Step' latch: Same as 'Decel Stop'. Regardless of how 'Latch Decel / Braking' is set, a reverse command below 50% will have no impact on the speed but direction corrections remain possible. **Note:** '3-Step' latch indication is refreshed when the input command is released.

Parameter	Range	Description
Latch Reverse Forward (Only available with the DM connected)		**WARNING:** Do not enable any latch mode if the mode switch is not easily accessible for the user to stop the chair in any situation. An emergency stop method is highly recommended for any latch setting! '1-Step' latch: Latch command is active on reverse command over 50% of the input device. If the chair is not driving latched, a reverse command below 50% will drive without latch. If the chair is driving latched, a reverse command below 50% will not have any impact on the speed but direction corrections are possible. When a forward command over 50% is given, the unit will come to a soft stop. Latch will be canceled and chair stops with the drive profile 'Decel' setting. A forward command below 50% will not have any impact on the speed but direction corrections are possible. Latch with '1-Switch': If 'Latch Reverse' is active, and a reverse-right or reverse-left command is given, no reverse command is executed, but a 50% direction command of the actual drive profile settings. If 'Latch Reverse' is active, any forward command (forward, forward-right, forward-left) brings the unit to a soft stop. **Note:** If the input device is held after the unit has stopped, no command will be generated. To move in forward direction, a new command must be given.
Latch Timeout Forward (Only available with the DM connected)	5 – 120 s	Defines the time the chair will continue to drive latched without input command. After 'Latch Timeout' setting, the chair will come to a stop if no input command was given during the 'Latch Timeout' period. Dependency: 'Latch Timeout' is a common setting for 'Latch Forward' and 'Latch Reverse' commands in the drive profile. **Note:** The parameter 'Latch Timeout Disable' should not be set to 'Yes'.

Startup Configuration Parameters

Startup configuration defines how the system behaves when it is turned on, what input device to use and the first screen shown.

Parameter	Range	Description
Input Device Selection		'Default Input Device': At startup, the system activates the input device configured under 'Default Input Device'. If this device is missing (faulty or not connected to the system), the 'Input Device Selection Screen' will appear. 'Last Device Used': At startup, the system activates the last used input device. If this device is missing or if the Attendant Control was last used, the 'Input Device Selection Screen' will appear. 'Input Device Selection Screen': At startup all configured and connected input devices will appear. 'Power On Device': At startup, the input device used at power on will be active.
Input Device Selection Direction		Defines how an input device is selected if the system was powered up in the 'Input Device Selection Screen' (parameter 'Input Device Selection' set to 'Input Device Selection Screen'). The input device giving a 'Left, Right, Left-Right-Left, Right-Left-Right' command governing the setting is selected as the active input device.
Default Input Device		At startup, the system activates the input device configured: 'Display Module, Hand control, SCIM, 1-Switch Scanner' (parameter 'Input Device Selection' set to 'Default Input Device'). If this device is missing (faulty or not connected to the system), the 'Input Device Selection Screen' will appear.
User Entry Point		Defines the screen, menu, or function the system will enter after power up. 'Home' will enter the Home screen. 'Last Used' will enter the screen, menu, or function that was last used before the system was powered off. Any other available settings will behave accordingly. If a configured entry point is not available due to the system configuration (e.g. '4th Drive Profile'), the Home screen will be entered.

Hand Control Standard Parameters

The following sections describe the Hand Control Standard parameters.

- HCS: Profile Setup Menu
- HCS: Input Configuration Menu
- HCS: Joystick Setup Menu
- HCS: 3-Direction Arrow Toggle Menu
- HCS: Soft Key Setup Menu

- HCS: Soft Key Assignment Menu
- HCS: Button Operation Menu
- HCS: Device Options / Timing Menu
- HCS: Switch Options /Timing Menu
- HCS: Jack Commands Menu
- HCS: Jack Commands (HCS with DM) Menu
- HCS: Menu Settings Menu
- HCS: Menu Entries (HCS with DM) Menu
- HCS: Standby Select Menu
- HCS: Sleep Menu
- HCS: Latch Driving Menu
- HCS: User Speed Adjust Menu
- HCS: Profile Change Stop Menu
- HCS: Auto Shutoff Menu

HCS: Profile Setup Menu

Parameter	Range	Description
Mode		Determines the operation for that particular profile in the given order, 1 to 6. If the same mode is configured twice, the system shows the first placed mode only. Disabled profiles do not show on the system. A reverse mode command is disregarded at the first drive profile for safety reasons. Mode shortcut commands change between the profile main types that are Drive, AUX, Seat according to the configured order.

HCS: Input Configuration Menu

Parameter	Range	Description
HCS Input Configuration		Defines 'Hand control' operation modes: 'Proportional Joystick or Switched Joystick.
HCS Input Configuration (Only available with the DM connected)		Defines 'Hand control' operation modes when DM connected: 'Proportional Joystick, Switched Joystick, 3 Direction Proportional or 3 direction Switched.

HCS: Joystick Setup Menu

Parameter	Range	Description
Center Deadband	10 – 50 %	Defines how far the input device must be operated from center for a command to be recognized by the system. The value corresponds to the diameter of a circle around the center position. No drive or menu command will be generated unless the input device is operated out of this circle. **Note:** Increasing the 'Center Deadband' value could be useful for an operator with a severe hand tremor.
Tremor Suppression	0 – 100 %	Setting suppresses a tremor on the proportional input device. 0% equals no, 100% equals maximum tremor suppression. **Note:** When a short command is used to operate the system (e.g. when 3-way operation is configured for a device) the 'Tremor Suppression' value should not be set over 90%, otherwise short commands will be ignored.
Assigned Direction		The Direction Assignment function is used to select which command is used for forward and steering movements of the wheelchair. Dependency: To determine the proper assignment of the direction the function "Assign Directions" is used.
Forward Throw	30 – 100 %	Sets the percentage of movement of a proportional input device (joystick) in the forward direction to achieve maximum forward driving speed within the drive profile.
Reverse Throw	30 – 100 %	Same as Forward Throw, but for reverse direction.
Left Throw	30 – 100 %	Same as Forward Throw, but for left direction.
Right Throw	30 – 100 %	Same as Forward Throw, but for right direction.

HCS: 3-Direction Arrow Toggle Menu

Note:

These parameters are available only when the DM is connected.

Parameter	Range	Description
Toggle Command Time	200 – 4000 ms	Defines the time in which a command is detected as a toggle command. Toggle while driving: The forward / reverse direction must be operated longer than 'Toggle De-bounce Time', but shorter than 'Toggle De-bounce Time' + 'Toggle Command Time'. To issue a drive command the forward / reverse direction must be operated longer than 'Toggle Debounce Time' + 'Toggle Command Time'. Toggle while stopped: The forward / reverse direction must be operated shorter than 'Toggle Command Time', To issue a drive command the forward / reverse direction must be operated longer then 'Toggle Command Time'.
Toggle De-bounce Time	0 – 4000ms	Defines the time the input command must be operated while driving before it is recognized as a command (de-bounced). This timing exists only while driving and applies for all 3-way input devices.
Toggle In Seat Command	200 – 4000ms	Defines the time within which a toggle command is possible in Seat mode. **Note:** This parameter is only used for '4-Switch Head' and '5-Switch Head' in Seat mode.
Latch Toggle Auto Flip	Off / On	If set to 'Off' and first acceleration command has been pressed for 500 ms, the arrow remains in the current driving direction. If first acceleration command is released in 500 ms, the arrow will auto flip to the opposite direction assuming that the movement was unintended and the individual wants to stop quickly. If set to 'On', the arrow will auto flip to opposite direction as soon as command is released and latch is activated. **WARNING:** Emergency Stop Switch highly recommended.
Toggle In Drive	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in a drive profile is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary
Toggle While Driving	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled' when the chair is in motion, the direction cannot be toggled. **Note:** If set to 'Disabled', an alternative toggling method or stopping the chair is necessary.

Parameter	Range	Description
Toggle In Seat	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in 'Seat' is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.
Toggle in Aux	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in the auxiliary menu is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.
Toggle In Bluetooth	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in the Bluetooth menu is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.
Toggle In ECM	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in the ECM menu is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.

HCS: Soft Key Setup Menu

Note:

These parameters are not available when the DM is connected.

Parameter	Range	Description
Soft Keys Drive 1-4 and Seat		If 'User' is selected, the soft key page will not change when navigating to the next profile. If certain soft key functions are not applicable for that profile, they are not displayed. If 'Page x' is selected, the defined page will be shown when navigating to the profile. The page key remains operable to the user. If the selected page is not configured, the next applicable configured page is displayed. If 'Disabled' is selected, there are no soft key functions available for that screen. The page key is disabled. By setting all screens (Drive 1-4 and Seat) to 'Disabled', the soft key functions are switched off.
Speed Indication		This parameter configures information to a soft key page. If a page is configured for speed indication, no other soft key functions can be assigned to that page and speed is displayed instead. The information page is controllable by the user as any other page. page is available for soft key function assignment.
Distance Indication		This parameter configures information to a soft key page. If a page is configured for distance indication, no other soft key functions can be assigned to that page and distance is displayed instead. The information page is controllable by the user as any other page.
Time Indication		This parameter configures information to a soft key page. If a page is configured for time indication, no other soft key functions can be assigned to that page and time is displayed instead. The information page is controllable by the user as any other page.
Light Soft Keys	Disabled / Enabled	This parameter supports on-road regulations where light controls are mandatory on the wheelchair. If 'Enabled', the functions for indicator left, lights, and indicator right are permanently configured to the soft keys and operable in all Hand Control Standard modes while the system is powered on. In Settings and Bluetooth, the light keys and operation status are not displayed, but operable. If enabled, no other soft key functions can be used and the page key is disabled. If 'Disabled', indicators and lights can also be configured to any soft key page without permanent access.

HCS: Soft Key Assignment Menu

Note:

These parameters are not available when the DM is connected.

Parameter	Range	Description
Soft Key / Page Assignment		This parameter configures a soft key function to a certain soft key and page. The defaults offer a useful function assignment for most users. If 'Inactive' is selected, the position on that page remains empty and the relating soft key is disabled. Only configured pages with at least one active function are displayed. The following functions are not displayed in the Seat screen: All 'Seat' functions, the 'Speed Up / Down' functions, the 'Seat' shortcut, 'Speed Indication'. The page key on the hand control navigates forward though the configured pages. Empty pages (not configured or not displayed) are skipped.

HCS: Button Operation Menu

Parameter	Range	Description
Horn Button	Disabled / Enabled	Defines whether the Horn button is 'Enabled' or 'Disabled' on the Hand control.

HCS: Device Options / Timing Menu

Parameter	Range	Description
Device Double Command		A double command is only processed when the chair has stopped or is at stand-still. The parameter defines whether 'Device Double Command' is 'Disabled', or assigned to 'Enabled Left' or 'Enabled Right'. If 'Enabled Left or 'Enabled Right', a double command with a specialty input device will perform a 'Mode' command. If 'Disabled', the left or right command will perform the associated drive command. **Note:** When 'Enabled', the 'Long Command Time' will dictate how much time the system must wait after the direction is pressed before it activates the function.
Double Command Time	200 – 4000 ms	Defines the time required after command release to give a second command to execute a double command.
Long Command Time	200 – 4000 ms	Defines how long an input command must be operated to execute a long command without waiting for the double command.

HCS: Switch Options /Timing Menu

Parameter	Range	Description
Mode Jack Supervision		Disabled': If switch becomes disconnected, no action is taken. 'Stop': If switch becomes disconnected, the chair comes to a smooth stop and a warning, '(Device) Mode Jack disconnected' is displayed. No driving is allowed until the Mode Jack switch is reconnected. 'Rescue Mode': If switch becomes disconnected, the chair enters rescue drive mode and displays a warning, '(Device) Mode Jack disconnected'. Once the Mode Jack switch is reconnected, the chair will drive at normal speed. **WARNING!** If switch becomes disconnected, the chair continues to drive normally and a warning, '(Device) Mode Jack disconnected' will be displayed.
On / Off Jack Supervision		Same as Mode Jack Supervision, but for On / Off Jack
Mode Jack Configuration Type		The 'Configuration' setting assigns the Mode Jack to execute short, double or long commands (see settings under 'Jack Commands'). Device Mode Jack can be set to 'Mapped I/O' to be available for mapped I/O purpose (output possibilities according to the 'Mapped I/O Configurator').

Parameter	Range	Description
Jack 1 Double Command Time	200 – 4000 ms	It sets Jack 1 (jack tip) double command time, defining within what time the second command has to follow to execute a double command. Otherwise the command will be interpreted as a short command. For assignable commands, see menu 'Jack Commands'.
Jack 1 Long Command Time	200 – 4000 ms	It sets Jack 1 (jack tip) long command time, defining how long the switch must be pressed to execute a long command. For assignable commands, see menu 'Jack Commands'.
Jack 2 Double Command Time	200 – 4000 ms	Same as Jack 1 Double Command Time, but for Jack 2.
Jack 2 Long Command Time	200 – 4000 ms	Same as Jack 1 Long Command Time, but for Jack 2.
Mode Jack Switch Type	1 Switch / 2 Switch	This parameter defines if the mode stereo jack processes one or two switches. If '1 Switch' is chosen, only Jack 1 commands (see menu 'Jack Commands') are supported; the switch must be wired to the jack tip. Set to '2 Switch', Jack 1 and Jack 2 commands are processed, where the second switch is wired to the jack ring. **Important:** If a single switch is plugged into the 'Mode Jack' or 'On / Off Jack', do not set 'Mode Jack Switch Type' or 'On / Off Jack Switch Type' to 'Switch 2' nor configure any 'Jack 2' function.
On / Off Jack Switch Type	1 Switch / 2 Switch	Same as Mode Jack Switch Type, but for On / Off Jack.
Mode Jack E-Stop		Defines how the chair stops if 'Mode Jack E-Stop' is set to 'Decel Stop' or 'Quick Stop' and Mode Jack is operated. • 'Decel Stop': Any activation of the Mode Jack switch while driving will cause the unit to come to a soft stop. • 'Quick Stop': Any activation of the Mode Jack switch while driving will cause the unit to perform a quick stop. While the chair is at rest, the Mode Jack will perform the configured functions.
On / Off E-Stop		Same as Mode Jack E-Stop, but for On / Off Jack.

HCS: Jack Commands Menu

Parameter	Range	Description
Mode Jack Short Command		Assigns one of the following functions / shortcuts to the mode jack short command: 'Mode, Mode Shortcut, Home, Enter Lock'. If set to 'Inactive', no mode jack short command is recognized by the system. **Important:** If a single switch is plugged into the 'Mode Jack' or 'On / Off Jack', do not set 'Mode Jack Switch Type' or 'On / Off Jack Switch Type' to 'Switch 2' nor configure any 'Jack 2' function.
Mode Jack Long Command		Same as Mode Jack Short Command, but for Mode Jack Long Command.
Mode Jack Double Command		Same as Mode Jack Short Command, but for Mode Jack Double Command.
On / Off Jack Short Command		Same as Mode Jack Short Command, but for On / Off Jack Short Command. (Includes additional option for Power Off.)
On / Off Jack Long Command		Same as Mode Jack Short Command, but for On / Off Jack Long Command. (Includes additional option for Power Off.)
On / Off Jack Double Command		Same as Mode Jack Short Command, but for On / Off Jack Double Command. (Includes additional option for Power Off.)

HCS: Jack Commands (HCS with DM) Menu

Note:

These parameters are available only when the DM is connected.

Parameter	Range	Description
Mode Jack Short Command		Assigns one of the following functions / shortcuts to the mode jack short command: 'Mode, Mode Shortcut, Toggle, Sleep, Home, Enter Lock'. If set to 'Inactive', no mode jack short command is recognized by the system. **Important:** If a single switch is plugged into the 'Mode Jack' or 'On / Off Jack', do not set 'Mode Jack Switch Type' or 'On / Off Jack Switch Type' to 'Switch 2' nor configure any 'Jack 2' function.
Mode Jack Long Command		Same as Mode Jack Short Command, but for Mode Jack Long Command.
Mode Jack Double Command		Same as Mode Jack Short Command, but for Mode Jack Double Command.

Parameter	Range	Description
On / Off Jack Short Command		Same as Mode Jack Short Command, but for On / Off Jack Short Command. (Includes additional option for Power Off.)
On / Off Jack Long Command		Same as Mode Jack Short Command, but for On / Off Jack Long Command. (Includes additional option for Power Off.)
On / Off Jack Double Command		Same as Mode Jack Short Command, but for On / Off Jack Double Command. (Includes additional option for Power Off.)

HCS: Menu Settings Menu

Parameter	Range	Description
Menu Navigation Mode (Only available with the DM connected)		'Manual': Menu commands are generated manually and are not repeated. 'Auto Repeat': Moving from one menu item to the next will be repeated automatically as long as the command is active. 'Auto Change': The menu changes from one item to the next in a pre- determined time 'Menu Navigation Timing' with no input command.
Menu Navigation Timing	200 – 2000 ms	For 'Auto Change' Mode setting in 'Menu Navigation Mode' this parameter sets the time to move from one menu item to the next.
List Navigation Forward Input (Only available with the DM connected)		Assigns a specific navigation command to the forward direction. Assignment is valid for all list menus. • 'Scroll Up' moves upwards through the list • 'Scroll Down' moves downwards through the list • 'Select' selects the highlighted menu entry • 'Back Up' returns to the previous menu • 'Inactive' disables directional command **Note:** If 'Auto Change' is chosen only 'Select' and 'Back Up' are active.
List Navigation Left Input (Only available with the DM connected)		Same as List Navigation Forward Input, but for left input
List Navigation Reverse Input (Only available with the DM connected)		Same as List Navigation Forward Input, but for reverse input
List Navigation Right Input (Only available with the DM connected)		Same as List Navigation Forward Input, but for right input

HCS: Menu Entries (HCS with DM) Menu

Note:

These parameters are available only when the DM is connected.

Parameter	Range	Description
Settings	Disabled / Enabled	Enables / disables the auxiliary menu entry 'Settings'. If enabled, system settings are available to the user in the auxiliary menu
Show Change Input device	Disabled / Enabled	Enables / disables the auxiliary menu entry 'Change Input Device'. If enabled, the 'Change Input Device' option is available to the user in the auxiliary menu.

HCS: Standby Select Menu

Note:

These parameters are available only when the DM is connected.

Parameter	Range	Description
Standby Select	Disabled / Enabled	Standby Select' allows a user to operate the system without using a mode switch. The system changes to the 'Standby Select' screen if no input command was given for the programmed 'Standby Select Timeout'.
Standby Select Timeout	1 – 120 s	Defines the time after which the system changes to the 'Standby Select' screen if no valid command was given.
Standby Aux Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the auxiliary menu. If 'Disabled', an alternative mode method has to be available.
Standby Seat Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the seat screen. If 'Disabled', an alternative Mode method has to be available.

HCS: Sleep Menu

Note:

These parameters are available only when the DM is connected.

Parameter	Range	Description
Sleep Timeout	0 – 240 min	Defines the time to elapse after the last command given before the system enters the 'Sleep Power Mode'.
Sleep Power Mode	Disabled / Enabled	If 'Enabled', the display will go dark when 'Sleep Timeout' has elapsed or 'Sleep Power Mode' has been executed. To wake up the system with a Head Input Device, a left-right-left command must be given. Any command will wake up the system with any other input device. If 'Disabled', this function is not available.
Wake Up		Defines how the system can be woken up from 'Sleep Power Mode'. Available setting options: 'Mode, Left, Right, Left-Right-Left (default), Right-Left-Right'. 'Mode' enables the wake up by Mode command on HC, SAJ and DM. Alternative ways to wake the system up: • Jacks (Mode or On / Off) if configured to enter sleep • Reminder message (popup message) • Error message (popup message) • On / Off keys on HC, SAJ and DM. No wake up will cause the following: • Auto Change • Standby Select • MIOs • ED 4-way cursor button • AC Jacks. 1-Switch Scanner: Any switch command will wake the system up.

HCS: Latch Driving Menu

Note:

These parameters are available only when the DM is connected.

Parameter	Range	Description
Latch Driving Visibility	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Latch Driving'. If 'Enabled', the option to enable / disable latch for configured latch drive profiles is available to the user in the Auxiliary menu.

HCS: User Speed Adjust Menu

Parameter	Range	Description
User Speed Adjust	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Speed Adjust'. If 'Enabled', the 'Speed Adjust' option is available to the user in the Auxiliary menu.
Drive 1	0 – 10	If 'User Speed Adjust' is 'Enabled', the user has the ability to adjusts the speed of each drive profile in steps of 10% (0 – 10) in the Auxiliary menu. If 'User Speed Adjust' is 'Disabled', the settings of 'Speed Adjust' are disregarded and the settings of the corresponding drive profile are taken.
Drive 2	0 – 10	Same as Drive 1.
Drive 3	0 – 10	Same as Drive 1.
Drive 4	0 – 10	Same as Drive 1.

HCS: Profile Change Stop Menu

Parameter	Range	Description
Profile Change Stop Drive	Disabled / Enabled	If 'Enabled', a mode command always stops the driving. After the chair has stopped the mode command is executed. If 'Disabled', a mode command changes to the next drive profile while driving without stop, if the next profile is a drive profile. If the next profile is Auxiliary or Seat, driving will stop upon one mode command and the profile will subsequently change.

HCS: Auto Shutoff Menu

Parameter	Range	Description
Auto Shutoff	0 – 240 min	Defines the time to elapse before the system powers down after the last input command. A power on command by the user will restart the system. Use this parameter to save battery capacity. **Note:** A setting of 0 min disables Auto Shutoff.

Hand Control Basic Parameters

The following sections describe the Hand Control Basic parameters.

HCB: Profile Setup Menu

Parameter	Range	Description
Drive Profile Setup		Determines the operation for a particular drive profile in the given order, 1 through 4. If a same profile is configured twice, the system shows the first placed profile only. Disabled profiles do not show on the system.

HCB: Input Configuration Menu

Parameter	Range	Description
HC Input Configuration		Defines the HCB operation modes, which are 'Proportional Joystick' or 'Switched Joystick'.

HCB: Joystick Setup Menu

Parameter	Range	Description
Center Deadband	14 – 50 %	Defines how far the input device must be operated from center for a command to be recognized by the system. The value corresponds to the diameter of a circle around the center position. No drive or menu command will be generated unless the input device is operated out of this circle. **Note:** Increasing the 'Center Deadband' value could be useful for an operator with a severe hand tremor.

Parameter	Range	Description
Tremor Suppression	0 – 100 %	Setting suppresses a tremor on the proportional input device. 0% equals no, 100% equals maximum tremor suppression. **Note:** When a short command is used to operate the system (e.g., when 3-way operation is configured for a device), the 'Tremor Suppression' value should not be set over 90%, otherwise short commands will be ignored.
Assigned Direction		The Direction Assignment function is used to select which command is used for forward and steering movements of the wheelchair. **Dependency**: To determine the proper assignment of the direction, the function "Assign Directions" is used.
Forward Throw	30 – 100 %	Sets the percentage of movement of a proportional input device (joystick) in the forward direction to achieve maximum forward driving speed within the drive profile.
Reverse Throw	30 – 100 %	Same as Forward Throw, but for the reverse direction.
Left Throw	30 – 100 %	Same as Forward Throw, but for the left direction.
Right Throw	30 – 100 %	Same as Forward Throw, but for the right direction.

HCB: Button Operation Menu

Parameter	Range	Description
Horn Button	Disabled / Enabled	Defines whether the horn button is 'Enabled' or 'Disabled' on the Hand Control Basic.
Key I		Assigns shortcuts to the **I** key to access the 'Seat Menu'. The key can be set to 'Mode' or 'Custom (MIO)'. Custom MIO makes the system available for mapped I/O purposes ('Mapped I/O Configurator').
Key II		Same as 'Key I', but for the **II** key.

HCB: Device Options / Timing Menu

Parameter	Range	Description
Device Double Command		A double command is only processed when the chair has stopped or is at stand-still. The parameter defines whether 'Device Double Command' is 'Disabled', or assigned to 'Enabled Left' or 'Enabled Right'. If 'Enabled Left' or 'Enabled Right', a double command with a specialty input device will perform a 'Mode' command. If 'Disabled', the left or right command will perform the associated drive command. **Note:** When 'Enabled', the 'Long Command Time' will dictate how much time the system must wait after the direction is pressed before it activates the function.
Double Command Time	200 – 4000 ms	Defines the time required after command release to give a second command to execute a double command.
Long Command Time	200 – 4000 ms	Defines how long an input command must be operated to execute a long command without waiting for the double command.

HCB: Switch Options / Timing Menu

Parameter	Range	Description
Jack 1 Double Command Time	200 – 4000 ms	Sets the Jack 1 (jack tip) double command time. This defines the time in which the second command has to follow to execute a double command. Otherwise, the command will be interpreted as a short command.
Jack 1 Long Command Time	200 – 4000 ms	Sets the Jack 1 (jack tip) long command time. This defines the time in which a switch must be pressed to execute a long command.

Note:

For assignable commands, see HCB: Jack Commands Menu.

HCB: Jack Commands Menu

Parameter	Range	Description
On / Off Jack Short Command		Assigns one of the following functions / shortcuts to the On / Off jack short command: 'Mode , Power Off, Enter Lock'. If set to 'Inactive', On / Off jack short commands are not recognized by the system.

Parameter	Range	Description
On / Off Jack Long Command		Same as 'On / Off Jack Short Command', but for 'On / Off Jack Long Command'.
On / Off Jack Double Command		Same as 'On / Off Jack Short Command', but for 'On / Off Jack Double Command'.

HCB: Profile Change Stop Menu

Parameter	Range	Description
Profile Change Stop Drive	Disabled / Enabled	If 'Enabled', a + / – command always stops the driving. After the chair has stopped the Drive profile command is executed. If 'Disabled', a + / – command changes to the next drive profile while driving without stopping.

HCB: Auto Shutoff Menu

Parameter	Range	Description
Auto Shutoff	0 – 240 min	Defines the time to elapse before the system powers down after the last input command. A power on command by the user will restart the system. Use this parameter to save battery capacity. **Note:** A setting of 0 minutes disables Auto Shutoff.

Display Module Parameters

The following sections describe the Display Module parameters.

- DM: Switch Options / Timing Menu
- DM: Jack Commands Menu

Related information

Display Module (DM)

DM: Switch Options / Timing Menu

Parameter	Range	Description
Mode Jack Supervision		Disabled': If switch becomes disconnected, no action is taken. 'Stop': If switch becomes disconnected, the chair comes to a smooth stop and a warning, '(Device) Mode Jack disconnected', is displayed. No driving is allowed until the Mode Jack switch is reconnected. 'Rescue Mode': If switch becomes disconnected, the chair enters rescue drive mode and displays a warning, '(Device) Mode Jack disconnected'. Once the Mode Jack switch is reconnected, the chair will drive at normal speed. 'Warning': If switch becomes disconnected, the chair continues to drive normally and a warning, '(Device) Mode Jack disconnected', will be displayed.
On / Off Jack Supervision		Same as Mode Jack Supervision, but for On / Off Jack
Mode Jack Configuration Type		The 'Configuration' setting assigns the Mode Jack to execute short, double or long commands (see DM: Jack Commands Menu). Device Mode Jack can be set to 'Mapped I/O' to be available for mapped I/O purpose (output possibilities according to the 'Mapped I/O Configurator').
Jack 1 Double Command Time	200 - 4000 ms	Sets the Jack 1 (jack tip) double command time, defining within what time the second command has to follow to execute a double command. Otherwise the command will be interpreted as a short command. For assignable commands, see the DM 'Jack Commands' menu.
Jack 1 Long Command Time	200 – 4000 ms	Sets the Jack 1 (jack tip) long command time, defining how long the switch must be pressed to execute a long command. For assignable commands, see the DM 'Jack Commands' menu.
Jack 2 Double Command Time	200 – 4000 ms	Same as Jack 1 Double Command Time, but for Jack 2.
Jack 2 Long Command Time	200 – 4000 ms	Same as Jack 1 Long Command Time, but for Jack 2.
Mode Jack Switch Type	1 Switch / 2 Switch	This parameter defines if the mode stereo jack processes one or two switches. If '1 Switch' is chosen, only Jack 1 commands on the DM 'Jack Commands' menu are supported; the switch must be wired to the jack tip. Set to '2 Switch', Jack 1 and Jack 2 commands are processed, where the second switch is wired to the jack ring. **Important:** If a single switch is plugged into the 'Mode Jack' or 'On / Off Jack', do not set 'Mode Jack Switch Type' or 'On / Off Jack Switch Type' to 'Switch 2' nor configure any 'Jack 2' function.

Parameter	Range	Description
On / Off Jack Switch Type	1 Switch / 2 Switch	Same as Mode Jack Switch Type, but for On / Off Jack.
Mode Jack E-Stop		Defines how the chair stops if 'Mode Jack E-Stop' is set to 'Decel Stop' or 'Quick Stop' and Mode Jack is operated. 'Decel Stop': Any activation of the Mode Jack switch while driving will cause the unit to come to a soft stop. 'Quick Stop': Any activation of the Mode Jack switch while driving will cause the unit to perform a quick stop. While the chair is at rest the Mode Jack will perform the configured functions.
On / Off E-Stop		Same as Mode Jack E-Stop, but for On / Off Jack.

DM: Jack Commands Menu

Parameter	Range	Description
Mode Jack Short Command		Assigns one of the following functions / shortcuts to the mode jack short command: 'Mode, Mode Shortcut, Toggle, Sleep, Home, Enter Lock'. If set to 'Inactive', no mode jack short command is recognized by the system. **Important:** If a single switch is plugged into the 'Mode Jack' or 'On / Off Jack', do not set 'Mode Jack Switch Type' or 'On / Off Jack Switch Type' to 'Switch 2' nor configure any 'Jack 2' function.
Mode Jack Long Command		Same as Mode Jack Short Command, but for Mode Jack Long Command.
Mode Jack Double Command		Same as Mode Jack Short Command, but for Mode Jack Double Command.
On / Off Jack Short Command		Same as Mode Jack Short Command, but for On / Off Jack Short Command.
On / Off Jack Long Command		Same as Mode Jack Short Command, but for On / Off Jack Long Command.
On / Off Jack Double Command		Same as Mode Jack Short Command, but for On / Off Jack Double Command.

Attendant Control Parameters

The following sections describe the Attendant Control parameters.

- AC: Profile Setup Menu
- AC: Joystick Setup Menu

- AC: Device Options / Timing Menu
- AC: Switch Options Menu
- AC: User Speed Adjust Menu

AC: Profile Setup Menu

Parameter	Range	Description
Mode		Determines the operation for that particular profile in the given order, 1 to 4. If a same mode is configured twice, the system shows the first placed mode only. Disabled profiles do not show on the system. A reverse mode command is disregarded at the first drive profile for safety reasons. Mode shortcut commands change between the profile main types that are Drive, AUX, Seat according to the configured order.

AC: Joystick Setup Menu

Parameter	Range	Description
Center Deadband	10 – 50 %	Defines how far the input device must be operated from center for a command to be recognized by the system. The value corresponds to the diameter of a circle around the center position. No drive or menu command will be generated unless the input device is operated out of this circle. **Note:** Increasing the 'Center Deadband' value could be useful for an operator with a severe hand tremor.
Tremor Suppression	0 – 100 %	Setting suppresses a tremor on the proportional input device. 0% equals no, 100% equals maximum tremor suppression. **Note:** When a short command is used to operate the system (e.g., when 3-way operation is configured for a device) the 'Tremor Suppression' value should not be set over 90%, otherwise short commands will be ignored.
Assigned Direction		The Direction Assignment function is used to select which command is used for forward and steering movements of the wheelchair. Dependency: To determine the proper assignment of the direction the function "Assign Directions" is used.

Parameter	Range	Description
Forward Throw	30 – 100 %	Sets the percentage of movement of a proportional input device (joystick) in the forward direction to achieve maximum forward driving speed within the drive profile.
Reverse Throw	30 – 100 %	Same as Forward Throw, but for the reverse direction.
Left Throw	30 – 100 %	Same as Forward Throw, but for the left direction.
Right Throw	30 – 100 %	Same as Forward Throw, but for the right direction.
Turn Off	Disabled / Enabled	Defines whether the user can power off the system while the Attendant Control has active system control. If set to 'Disabled', only an off command from the Attendant Control will power off the system.

AC: Device Options / Timing Menu

Parameter	Range	Description
Double Command Time	200 – 4000 ms	Defines the time required after command release to give a second command to execute a double command.
Long Command Time	200 – 4000 ms	Defines how long an input command must be operated to execute a long command without waiting for the double command.

AC: Switch Options Menu

Parameter	Range	Description
On/Off Jack Supervision		Disabled': If switch becomes disconnected, no action is taken. 'Stop': If switch becomes disconnected, the chair comes to a smooth stop and a warning, '(Device) Mode Jack disconnected', is displayed. No driving is allowed until the Mode Jack switch is reconnected. 'Rescue Mode': If switch becomes disconnected, the chair enters rescue drive mode and displays a warning, '(Device) Mode Jack disconnected'. Once the Mode Jack switch is reconnected, the chair will drive at normal speed. 'Warning': If switch becomes disconnected, the chair continues to drive normally and a warning, '(Device) Mode Jack disconnected', will be displayed.

AC: User Speed Adjust Menu

Parameter	Range	Description
User Speed Adjust	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Speed Adjust'. If 'enabled', the 'Speed Adjust' option is available to the user in the Auxiliary menu.
Drive 1	0 – 10	If 'User Speed Adjust' is 'Enabled', the user has the ability to adjust the speed of each drive profile in steps of 10% (0 – 10) in the Auxiliary menu. If 'User Speed Adjust' is 'Disabled', the settings of 'Speed Adjust' are disregarded and the settings of the corresponding drive profile are taken.
Drive 2	0 – 10	Same as Drive 1

Specialty Control Input Module Parameters

The following sections describe the Specialty Control Input Module parameters.

- SCIM: Profile Setup Menu
- SCIM: Input Configuration Menu
- SCIM: Mini Proportional Input Menu
- SCIM: Proportional Input Menu
- SCIM: 3-Direction Arrow Toggle Settings Menu
- SCIM: Device Options / Timing Menu
- SCIM: D-Sub (9-Pin) Menu
- SCIM: Menu Settings Menu
- SCIM: Menu Entries Menu
- SCIM: Standby Select Menu
- SCIM: Sleep Menu
- SCIM: Latch Driving Menu
- SCIM: User Speed Adjust Menu
- SCIM: Profile Change Stop Menu
- SCIM: Auto Shutoff Menu

SCIM: Profile Setup Menu

Parameter	Range	Description
Mode		Determines the operation for that particular profile in the given order, 1 to 6. If a same mode is configured twice, the system shows the first placed mode only. Disabled profiles do not show on the system. A reverse mode command is disregarded at the first drive profile for safety reasons. Mode shortcut commands change between the profile main types that are Drive, AUX, Seat, according to the configured order.

SCIM: Input Configuration Menu

Parameter	Range	Description
SCIM Input Configuration		Determines the input device to be connected to the SCIM. The Settings list shows all supported input devices. If set to 'No Device Connected', the system will not supervise the D-Sub connector, and no device will appear in the 'Input Device Selection Screen'.

SCIM: Mini Proportional Input Menu

Parameter	Range	Description
Center Deadband	10 – 50 %	Defines how far the input device must be operated from center for a command to be recognized by the system. The value corresponds to the diameter of a circle around the center position. No drive or menu command will be generated unless the input device is operated out of this circle. **Note:** Increasing the 'Center Deadband' value could be useful for an operator with a severe hand tremor.
Tremor Suppression	0 – 100 %	Suppresses a tremor on the proportional input device. 0% equals no, 100% equals maximum tremor suppression. **Note:** When a short command is used to operate the system (e.g., when 3-way operation is configured for a device) the 'Tremor Suppression' value should not be set over 90%, otherwise short commands will be ignored.
Forward Throw	30 – 100 %	Sets the percentage of movement of a proportional input device (joystick) in the forward direction to achieve maximum forward driving speed within the drive profile.
Reverse Throw	30 – 100 %	Same as Forward Throw, but for the reverse direction.

Parameter	Range	Description
Left Throw	30 – 100 %	Same as Forward Throw, but for the left direction.
Right Throw	30 – 100 %	Same as Forward Throw, but for the right direction.
Assigned Direction		The Direction Assignment function is used to select which command is used for forward and steering movements of the wheelchair. Dependency: To determine the proper assignment of the direction the function “Assign Directions" is used.
Auto Center Adjust	Disabled / Enabled	If set to ‘Enabled’, the center values for the X- and Y-axis of the proportional Specialty Input Device are temporarily adjusted during startup. In case of a missing center signal or large deviation between X- / Y-axis and the center reference signal, an out of center error shows during startup. In this case the ‘Auto Center Adjust’ must be set to ‘Disabled’ and the proportional calibration has to be done. If set to ‘Disabled’, it is strongly recommended to execute the proportional calibration in order to set the correct center values for Y- and X-axis and to have the full range of the connected proportional Specialty Input Device. **Note:** It is strongly recommended to perform the proportional calibration after a new proportional Specialty Input Device was connected to the system independent of the ‘Auto Center Adjust’ setting in order have the full range calibrated.
X Min	0.5 – 4 V	Defines the minimum value for the X-axis of the proportional Specialty Input Device. Usually this parameter is automatically set by the proportional device Calibration Function, but it can be manually adjusted if required.
Y Min	0.5 – 4 V	Same as X Min, but for the Y axis.
X Center	2 – 10 V	Defines the center value for the X-axis of the proportional Specialty Input Device. Usually this parameter is automatically set by the proportional device calibration function, but it can be manually adjusted if required.
Y Center	2 – 10 V	Same as X Center, but for the Y axis.
X Max	0.5 – 4 V	Defines the maximum value for the X-axis of the proportional Specialty Input Device. Usually this parameter is automatically set by the proportional device calibration function, but it can be manually adjusted if required.
Y Max	0.5 – 4 V	Same as X Max, but for the Y Axis.

SCIM: Proportional Input Menu

Parameter	Range	Description
Center Deadband	10 – 50 %	Defines how far the input device must be operated from center for a command to be recognized by the system. The value corresponds to the diameter of a circle around the center position. No drive or menu command will be generated unless the input device is operated out of this circle. **Note:** Increasing the 'Center Deadband' value could be useful for an operator with a severe hand tremor.
Tremor Suppression	0 – 100 %	Suppresses a tremor on the proportional input device. 0% equals no, 100% equals maximum tremor suppression. When a short command is used to operate the system (e.g., when 3-way operation is configured for a device) the 'Tremor Suppression' value should not be set over 90%, otherwise short commands will be ignored.
Forward Throw	30 – 100 %	Sets the percentage of movement of a proportional input device (joystick) in the forward direction to achieve maximum forward driving speed within the drive profile.
Reverse Throw	30 – 100 %	Same as Forward Throw, but for the reverse direction.
Left Throw	30 – 100 %	Same as Forward Throw, but for the left direction.
Right Throw	30 – 100 %	Same as Forward Throw, but for the right direction.
Assigned Direction		The Direction Assignment function is used to select which command is used for forward and steering movements of the wheelchair. Dependency: To determine the proper assignment of the direction the function "Assign Directions" is used.
Auto Center Adjust	Disabled / Enabled	If set to 'Enabled', the center values for the X- and Y-axis of the proportional Specialty Input Device are temporarily adjusted during startup. In case of a missing center signal or large deviation between X- / Y-axis and the center reference signal, an out of center error shows during startup. In this case the 'Auto Center Adjust' must be set to 'Disabled' and the proportional calibration has to be done. If set to 'Disabled', it is strongly recommended to execute the proportional calibration in order to set the correct center values for Y- and X-axis and to have the full range of the connected proportional Specialty Input Device. **Note:** It is strongly recommended to perform the proportional calibration after a new proportional Specialty Input Device was connected to the system independent of the 'Auto Center Adjust' setting in order have the full range calibrated.

Parameter	Range	Description
X Min	0.5 – 4 V	Defines the minimum value for the X-axis of the proportional Specialty Input Device. Usually this parameter is automatically set by the proportional device Calibration Function, but it can be manually adjusted if required.
Y Min	0.5 – 4 V	Same as X Min, but for the Y axis.
X Center	2 – 10 V	Defines the center value for the X-axis of the proportional Specialty Input Device. Usually this parameter is automatically set by the proportional device calibration function, but it can be manually adjusted if required.
Y Center	2 – 10 V	Same as X Center, but for the Y axis.
X Max	0.5 – 4 V	Defines the maximum value for the X-axis of the proportional Specialty Input Device. Usually this parameter is automatically set by the proportional device calibration function, but it can be manually adjusted if required.
Y Max	0.5 – 4 V	Same as X Max, but for the Y axis.

SCIM: 3-Direction Arrow Toggle Settings Menu

Parameter	Range	Description
Toggle Command Time	200 – 4000 ms	Defines the time in which a command is detected as a toggle command. Toggle while driving: The forward / reverse direction must be operated longer than 'Toggle De-bounce Time', but shorter than 'Toggle De-bounce Time' + 'Toggle Command Time'. To issue a drive command the forward / reverse direction must be operated longer than 'Toggle De-bounce Time' + 'Toggle Command Time'. Toggle while stopped: The forward / reverse direction must be operated shorter than 'Toggle Command Time'. To issue a drive command the forward / reverse direction must be operated longer then 'Toggle Command Time'.
Toggle De-bounce Time	0 – 4000 ms	Defines the time the input command must be operated while driving before it is recognized as a command (de-bounced). This timing exists only while driving and applies for all 3-Way Input Devices.
Toggle In Seat Command	200 – 4000 ms	Defines the time within which a toggle command is possible in Seat mode. **Note:** This parameter is only used for '4-Switch Head' and '5-Switch Head' in Seat mode.

Parameter	Range	Description
Latch Toggle Auto Flip	Off / On	If set to 'Off' and first acceleration command has been pressed for 500 ms, the arrow remains in the current driving direction. If the first acceleration command is released in 500 ms, the arrow will automatically flip to the opposite direction, assuming that the movement was unintended and the individual wants to stop quickly. If set to 'On', the arrow will automatically flip to the opposite direction as soon as the command is released and the latch is activated. **WARNING:** An Emergency Stop Switch is highly recommended.
Toggle In Drive	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in a drive profile is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.
Toggle While Driving	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled' when the chair is in motion, the direction cannot be toggled. **Note:** If set to 'Disabled', an alternative toggling method or stopping the chair is necessary.
Toggle In Seat	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in 'Seat' is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.
Toggle In Aux	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in the Auxiliary menu is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.

Parameter	Range	Description
Toggle In Bluetooth	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in the Bluetooth menu is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.
Toggle In IR	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in the IR menu is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.
Toggle In ECM	Disabled / Enabled	Is relevant for '3-Switch, 3-Switch Head, 3-Way Proportional Devices and 3-Way Proportional Head'. If set to 'Disabled', toggling in the ECM menu is not possible. **Note:** If set to 'Disabled', and toggling must be possible, an alternative toggling method is necessary.

SCIM: Device Options / Timing Menu

Parameter	Range	Description
Device Double Command		A double command is only processed when the chair has stopped / is at stand-still. The parameter defines whether 'Device Double Command' is 'Disabled', or assigned to 'Enabled Left' or 'Enabled Right'. If 'Enabled Left or 'Enabled Right', a double command with a specialty input device will perform a 'Mode' command. If 'Disabled', the left or right command will perform the associated drive command. **Note:** When 'Enabled', the 'Long Command Time' will dictate how much time the system must wait after the direction is pressed before it activates the function.
Double Command Time	200 – 4000 ms	Defines the time required after command release to give a second command to execute a double command.
Long Command Time	200 – 4000 ms	Defines how long an input command must be operated to execute a long command without waiting for the double command.

SCIM: D-Sub (9-Pin) Menu

Parameter	Range	Description
D-Sub Supervision	Disabled / Enabled	Defines whether the D-Sub supervision of the device is 'Disabled' or 'Enabled'. If 'Enabled' and the D-Sub-9 of the active input device is disconnected, a warning is issued. The chair will stop driving if in a drive profile. Auxiliary, Settings and Seat Profiles remain available.
Mode Short Command Type		Assigns one of the following functions / shortcuts to the D-Sub mode short command: 'Mode, Mode Shortcut, Toggle, Sleep, Home, Enter Lock'. 'Inactive' disables D-Sub mode short commands.
Mode Long Command Type		Same as Mode Short Command Type, but for Long Command
Mode Double Command Type		Same as Mode Short Command Type, but for Double Command
Mode Long Command Time	200 – 4000 ms	Defines how long an input command on D-Sub mode must be operated to execute a long command without waiting for the double command.
Mode Double Command Time	200 – 4000 ms	Defines the time required to give a second command on D-Sub mode to execute a double command. Otherwise the command will be interpreted as a short command.
D-Sub Mode E-Stop		Defines how the chair stops if 'D-Sub Mode E-Stop' is set to 'Decel Stop' or 'Quick Stop' and D-Sub Mode is operated. 'Decel Stop': Any activation of the D-Sub Mode switch while driving will cause the unit to come to a soft stop. 'Quick Stop': Any activation of the D-Sub Mode switch while driving will cause the unit to perform a quick stop. While the chair is at rest the D-Sub Mode will perform the configured functions.

SCIM: Menu Settings Menu

Parameter	Range	Description
Menu Navigation Mode		'Manual': Menu commands are generated manually and are not repeated. 'Auto Repeat': Moving from one menu item to the next will be repeated automatically as long as the command is active. 'Auto Change': The menu changes from one item to the next in a pre-determined time, 'Menu Navigation Timing', with no input command.

Parameter	Range	Description
Menu Navigation Timing	200 – 2000 ms	For the 'Auto Change' Mode setting in 'Menu Navigation Mode', this parameter sets the time to move from one menu item to the next.
List Navigation Forward Input		Assigns a specific navigation command to the forward direction. Assignment is valid for all list menus. • 'Scroll Up' moves upwards through the list • 'Scroll Down' moves downwards through the list • 'Select' selects the highlighted menu entry • 'Back Up' returns to the previous menu • 'Inactive' disables directional command **Note:** If 'Auto Change' is chosen only 'Select' and 'Back Up' are active.
List Navigation Left Input		Same as List Navigation Forward Input, but for the left input.
List Navigation Reverse Input		Same as List Navigation Forward Input, but for the reverse input.
List Navigation Right Input		Same as List Navigation Forward Input, but for the right input.

SCIM: Menu Entries Menu

Parameter	Range	Description
Settings	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Settings'. If enabled, system settings are available to the user in the Auxiliary menu.
Show Change Input device	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Change Input Device'. If enabled, the 'Change Input Device' option is available to the user in the Auxiliary menu.

SCIM: Standby Select Menu

Parameter	Range	Description
Standby Select	Disabled / Enabled	'Standby Select' allows a user to operate the system without using a mode switch. The system changes to the 'Standby Select' screen if no input command was given for the programmed 'Standby Select Timeout'.

Parameter	Range	Description
Standby Select Timeout	1 – 120 s	Defines the time after which the system changes to the 'Standby Select' screen if no valid command was given.
Standby Aux Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the Auxiliary menu. If 'Disabled', an alternative mode method has to be available.
Standby Seat Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the seat screen. If 'Disabled', an alternative Mode method has to be available.

SCIM: Sleep Menu

Parameter	Range	Description
Sleep Timeout	0 – 240 min	Defines the time to elapse after the last command given before the system enters the 'Sleep Power Mode'.
Sleep Power Mode	Disabled / Enabled	If 'Enabled', the display will go dark when 'Sleep Timeout' has elapsed or 'Sleep Power Mode' has been executed. To wake up the system with a Head Input Device, a left-right-left command must be given. Any command will wake up the system with any other input device. If 'Disabled', this function is not available.
Wake Up		Defines how the system can be woken up from 'Sleep Power Mode'. Available setting options: 'Mode, Left, Right, Left-Right-Left (default), Right-Left-Right'. 'Mode' enables the wake up by Mode command on HC and DM. Alternative ways to wake the system up: • Jacks (Mode or On / Off) if configured to enter sleep • Reminder message (popup message) • Error message (popup message) • On / Off keys on HC and DM No wake up will cause the following: • Auto Change • Standby Select • MIOs • DM 4-way cursor button • AC Jacks 1-Switch Scanner: Any switch command will wake the system up.

SCIM: Latch Driving Menu

Parameter	Range	Description
Latch Driving Visibility	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Latch Driving'. If 'Enabled', the option to enable / disable latch for configured latch drive profiles is available to the user in the Auxiliary menu.

SCIM: User Speed Adjust Menu

Parameter	Range	Description
User Speed Adjust	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Speed Adjust'. If 'enabled', the 'Speed Adjust' option is available to the user in the Auxiliary menu.
Drive 1	0 – 10	If 'User Speed Adjust' is 'Enabled', the user has the ability to adjust the speed of each drive profile in steps of 10% (0 – 10) in the Auxiliary menu. If 'User Speed Adjust' is 'Disabled', the settings of 'Speed Adjust' are disregarded and the settings of the corresponding drive profile are taken.
Drive 2	0 – 10	Same as Drive 1.
Drive 3	0 – 10	Same as Drive 1.
Drive 4	0 – 10	Same as Drive 1.

SCIM: Profile Change Stop Menu

Parameter	Range	Description
Profile Change Stop Drive	Disabled / Enabled	If 'Enabled', a mode command always stops the driving. After the chair has stopped the mode command is executed. If 'Disabled', a mode command changes to the next drive profile while driving without stop, if the next profile is a drive profile. If the next profile is Auxiliary or Seat, driving will stop upon one mode command and the profile will subsequently change.

SCIM: Auto Shutoff Menu

Parameter	Range	Description
Auto Shutoff	0 – 240 min	Defines the time to elapse before the system powers down after the last input command. A power on command by the user will restart the system. Use this parameter to save battery capacity. **Note:** A setting of 0 min disables Auto Shutoff.

Sip & Puff Module Parameters

The following sections describe the Sip & Puff Module parameters.

- SPM Profile Setup Menu
- SPM: Input Configuration Menu
- SPM: Pressure Fine Adjustment Menu
- SPM: Pressure Direction Adjustment Menu
- SPM: Device Options / Timing Menu
- SPM: Menu Settings Menu
- SPM: Menu Entries Menu
- SPM: Standby Select Menu
- SPM: Sleep Menu
- SPM: Latch Driving Menu
- SPM: User Speed Adjust Menu
- SPM: Profile Change Stop Menu
- SPM: Auto Shutoff Menu
- SPM: Calibration Menu

SPM Profile Setup Menu

Parameter	Range	Description
Mode		Determines the operation for that particular profile in the given order, 1 to 6. If the same mode is configured twice, the system shows the first placed mode only. Disabled profiles do not show on the system. A reverse mode command is disregarded at the first drive profile for safety reasons. Mode shortcut commands change between the profile main types that are Drive, AUX, Seat, according to the configured order.

SPM: Input Configuration Menu

Parameter	Range	Description
SNP Input Configuration		Defines the operation mode of the 'Sip & Puff': '4 Pressure, 2 Pressure'.

SPM: Pressure Fine Adjustment Menu

Parameter	Range	Description
4 Pressure Hard Puff	15 – 100 %	Defines the pressure level that must be applied to give a 'Hard Puff' command.
4 Pressure Hard Sip	15 – 100 %	Defines the pressure level that must be applied to give a 'Hard Sip' command.
4 Pressure Soft Puff	8 – 100 %	Defines the pressure level that must be applied to give a 'Soft Puff' command.
4 Pressure Soft Sip	8 – 100 %	Defines the pressure level that must be applied to give a 'Soft Sip' command.
Sampling Delay Puff	20 – 1000 ms	Defines the time that a 'Puff' command must be applied for, before it is recognized by the system. It is recommended to set this parameter as low as possible for '2 Pressure' operation.
Sampling Delay Sip	20 – 1000 ms	Defines the time that a 'Sip' command must be applied for, before it is recognized by the system. It is recommended to set this parameter as low as possible for '2 Pressure' operation.
Hard Hyst	2 – 10 %	Defines the amount of pressure that a hard command must drop below to be released. The gap between command activation and command release is called hysteresis.
New Command Level	1 – 10 %	Defines the pressure that a command has to fall below before the next command is accepted.
Soft Hyst	2 – 10 %	Defines the amount of pressure that a soft command must drop below to be released. The gap between command activation and command release is called hysteresis.
2 Pressure Puff	8 – 100 %	Defines the pressure level that must be applied to give a 'Puff' command.
2 Pressure Sip	8 – 100 %	Defines the pressure level that must be applied to give a 'Sip' command.

SPM: Pressure Direction Adjustment Menu

Parameter	Range	Description
Four Pressure Forward Assignment		Defines the forward pressure assignment: 'Hard Sip, Hard Puff, Soft Sip, Soft Puff'.
Four Pressure Left Assignment		Same as Four Pressure Forward Assignment, but for Left Assignment.
Four Pressure Reverse Assignment		Same as Four Pressure Forward Assignment, but for Reverse Assignment.
Four Pressure Right Assignment		Same as Four Pressure Forward Assignment, but for Right Assignment.
Two Pressure Forward Assignment		Defines the forward pressure assignment: 'Sip Continuous, Puff Continuous, Sip Short-Continuous, Puff Short-Continuous'.
Two Pressure Left Assignment		Same as Two Pressure Forward Assignment, but for Left Assignment.
Two Pressure Reverse Assignment		Same as Two Pressure Forward Assignment, but for Reverse Assignment.
Two Pressure Right Assignment		Same as Two Pressure Forward Assignment, but for Right Assignment.

SPM: Device Options / Timing Menu

Parameter	Range	Description
Mode Command		Defines how a mode command is executed: 'Double Sip, Double Puff'. If 'Disabled', an alternative mode option has to be available.
Double Command Time	200 – 4000 ms	Defines the time required after command release to give a second command to execute a double command.
Long Command Time	200 – 4000 ms	Defines how long an input command must be operated to execute a long command without waiting for the double command.

SPM: Menu Settings Menu

Parameter	Range	Description
Menu Navigation Mode		'Manual': Menu commands are generated manually and are not repeated. 'Auto Repeat': Moving from one menu item to the next will be repeated automatically as long as the command is active. 'Auto Change': The menu changes from one item to the next in a pre-determined time, 'Menu Navigation Timing', with no input command.
Menu Navigation Timing	200 – 2000 ms	For the 'Auto Change' Mode setting in 'Menu Navigation Mode', this parameter sets the time to move from one menu item to the next.
List Navigation Forward Input		Assigns a specific navigation command to the forward direction. Assignment is valid for all list menus. • 'Scroll Up' moves upwards through the list • 'Scroll Down' moves downwards through the list • 'Select' selects the highlighted menu entry • 'Back Up' returns to the previous menu • 'Inactive' disables directional command **Note:** If 'Auto Change' is chosen only 'Select' and 'Back Up' are active.
List Navigation Left Input		Same as List Navigation Forward Input, but for the left input.
List Navigation Reverse Input		Same as List Navigation Forward Input, but for the reverse input.
List Navigation Right Input		Same as List Navigation Forward Input, but for the right input.

SPM: Menu Entries Menu

Parameter	Range	Description
Settings	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Settings'. If enabled, system settings are available to the user in the Auxiliary menu.
Show Change Input Device	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Change Input Device'. If enabled, the 'Change Input Device' option is available to the user in the Auxiliary menu.

SPM: Standby Select Menu

Parameter	Range	Description
Standby Select	Disabled / Enabled	Standby Select' allows a user to operate the system without using a mode switch. The system changes to the 'Standby Select' screen if no input command was given for the programmed 'Standby Select Timeout'.
Standby Select Timeout	1 – 120 s	Defines the time after which the system changes to the 'Standby Select' screen if no valid command was given.
Standby Aux Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the Auxiliary menu. If 'Disabled', an alternative mode method has to be available.
Standby Seat Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the seat screen. If 'Disabled', an alternative Mode method has to be available.

SPM: Sleep Menu

Parameter	Range	Description
Sleep Timeout	0 - 240 min	Defines the time to elapse after the last command given before the system enters the 'Sleep Power Mode'.
Sleep Power Mode	Disabled / Enabled	If 'Enabled', the display will go dark when 'Sleep Timeout' has elapsed or 'Sleep Power Mode' has been executed. To wake up the system with a Head Input Device, a left-right-left command must be given. Any command will wake up the system with any other input device. If 'Disabled', this function is not available.

Parameter	Range	Description
Wake Up		Defines how the system can be woken up from 'Sleep Power Mode'. Available setting options: 'Long Puff (default), Long Sip'. For '4 Pressure' configuration, this applies for both, soft or hard pressure commands. Alternative ways to wake the system up: • Jacks (Mode or On / Off) if configured to enter sleep • Reminder message (popup message) • Error message (popup message) • On / Off keys on HC, SAJ and ED No wake up will cause the following: • Auto Change • Standby Select • MIOs • ED 4-way cursor button • AC Jacks

SPM: Latch Driving Menu

Parameter	Range	Description
Latch Driving Visibility	Disabled / Enabled	Enables / disables the auxiliary menu entry 'Latch Driving'. If 'Enabled', the option to enable / disable latch for configured latch drive profiles is available to the user in the Auxiliary menu.

SPM: User Speed Adjust Menu

Parameter	Range	Description
User Speed Adjust	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Speed Adjust'. If 'enabled', the 'Speed Adjust' option is available to the user in the Auxiliary menu.
Drive 1	0 – 10	If 'User Speed Adjust' is 'Enabled', the user has the ability to adjust the speed of each drive profile in steps of 10% (0 – 10) in the Auxiliary menu. If 'User Speed Adjust' is 'Disabled', the settings of 'Speed Adjust' are disregarded and the settings of the corresponding drive profile are taken.
Drive 2	0 – 10	Same as Drive 1.
Drive 3	0 – 10	Same as Drive 1.
Drive 4	0 – 10	Same as Drive 1.

SPM: Profile Change Stop Menu

Parameter	Range	Description
Profile Change Stop Drive	Disabled / Enabled	If 'Enabled', a mode command always stops the driving. After the chair has stopped the mode command is executed. If 'Disabled', a mode command changes to the next drive profile while driving without stop, if the next profile is a drive profile. If the next profile is Auxiliary or Seat, driving will stop upon one mode command and the profile will subsequently change.

SPM: Auto Shutoff Menu

Parameter	Range	Description
Auto Shutoff	0 – 240 min	Defines the time to elapse before the system powers down after the last input command. A power on command by the user will restart the system. Use this parameter to save battery capacity. **Note:** A setting of 0 minutes disables Auto Shutoff.

SPM: Calibration Menu

Parameter	Range	Description
Pressure Sensor Calibration Sip	–12 – 5 kPa	Configures the available operation pressure window between a defined minimum of -0.5kPa (related to ambient pressure) and the maximum Sip (negative) pressure. The selected max value in kPa is considered as 100% reference for all other Sip parameters. The maximum Sip (negative) pressure is adjustable between –5kPa and –12kPa. A suggested setting according to standards is –6.8kPa.
Pressure Sensor Calibration Puff	5 – 12 kPa	Configures the available operation pressure window between a defined minimum of 0.5kPa (related to ambient pressure) and the maximum Puff (positive) pressure. The selected max value in kPa is considered as 100% reference for all other Puff parameters. The maximum Puff (positive) pressure is adjustable between 5kPa and 12kPa. A suggested setting according to standards is 6.8kPa.

1-Switch Scanner Parameters

The following sections describe the 1-Switch Scanner parameters.

- 1-Switch Scanner: Profile Setup Menu
- 1-Switch Scanner: 1-Switch Scan Settings Menu

- 1-Switch Scanner: Scan Order Menu
- 1-Switch Scanner: Menu Settings Menu
- 1-Switch Scanner: Menu Entries Menu
- 1-Switch Scanner: Standby Select Menu
- 1-Switch Scanner: Sleep Menu
- 1-Switch Scanner: Latch Driving Menu
- 1-Switch Scanner: User Speed Adjust Menu
- 1-Switch Scanner: Auto Shutoff Menu

1-Switch Scanner: Profile Setup Menu

Parameter	Range	Description
Mode		Determines the operation for that particular profile in the given order, 1 to 6. If the same mode is configured twice, the system shows the first placed mode only. Disabled profiles do not show on the system. A reverse mode command is disregarded at the first drive profile for safety reasons. Mode shortcut commands change between the profile main types that are Drive, AUX, Seat according to the configured order.

1-Switch Scanner: 1-Switch Scan Settings Menu

Parameter	Range	Description
1-Switch Scanner Enable	Disabled / Enabled	If 'Enabled', the '1-Switch Scanner' is available as an input device. • The 'D-Sub (9-Pin)' mode pin 6 defaults to operate the '1-Switch Scanner', implying that the configuration of 'D-Sub (9-Pin)' mode pin 6 is disregarded. • The 'On / Off Jack' and 'Mode Jack' default to operate the '1-Switch Scanner'. They are set to '1 Switch' operation and the individual configuration is disregarded. **Important:** If 'Input Device Selection' is set to 'Power On Device', the '1-Switch Scanner' cannot be activated directly. To activate '1-Switch Scanner' directly, the 'Input Device Selection' must be set to 'Default Input Device' and 'Default Input Device' must be set to '1-Switch Scanner'.
Scan Rate	0.5 – 5 s	Defines the scan speed: the higher the value, the slower the scanner will rotate. The scan function is only available when '1-Switch Scanner Enable' is set to 'Enabled'.

Parameter	Range	Description
E-Stop for Latch	Disabled / Enabled	If 'Enabled', the chair comes to a smooth stop when the '1-Switch Scanner' input is pressed for 'E-Stop Switch Hold Time'. **Important:** This parameter should be set to 'Disabled' only if an emergency stop switch is available. **Note:** This parameter is only used in combination with '1-Switch Scanner' and 'Latch' driving.
E-Stop Switch Hold Time	500 – 1500 ms	Defines the time after which latch driving is stopped if the switch is kept pressed. **Note:** If the chair is driving forward in Latch mode and the user presses the switch while the arrow points to the right, the chair will drive to the right until 'E-Stop Switch Hold Time' elapses, and then the chair comes to a smooth stop. This parameter is only used in combination with '1-Switch Scanner' and 'Latch' driving.
1-Switch Timeout	0 – 60 s	Defines how long the switch can be pressed before driving is stopped. When set to '0', the '1-Switch Timeout' is disabled. **Note:** This parameter is only used in conjunction with '1-Switch Scanner'. '1-Switch Timeout' runs independently of 'Latch Timeout' and 'E-Stop For Latch'.
Mode Scan Option	Off / On	Defines whether the '1- Switch Scanner' scans through the 'Mode' option or not. If set to 'Off', the '1-Switch Scanner' skips the 'Mode' option. **Note:** If 'Mode Scan Option' is set to 'Off' and mode is required for system operation, an alternative mode method has to be available.
Mouse Move Directions		Defines how the mouse move screen is operated. Available options are '4-Direction' or '8-Direction' scanner. **Note:** This parameter is only used in conjunction with '1-Switch Scanner'.

1-Switch Scanner: Scan Order Menu

Parameter	Range	Description
Item 1		Defines 1st scanner position.

Parameter	Range	Description
Item 2		Defines 2nd scanner position.
Item 3		Defines 3rd scanner position.
Item 4		Defines 4th scanner position.
Item 5		Defines 5th scanner position.
Item 6		Defines 6th scanner position.
Item 7		Defines 7th scanner position.
Item 8		Defines 8th scanner position.
Item 9		Defines 9th scanner position.
Item 10		Defines 10th scanner position.

1-Switch Scanner: Menu Settings Menu

Parameter	Range	Description
Menu Navigation Mode		'Manual': Menu commands are generated manually and are not repeated. 'Auto Repeat': Moving from one menu item to the next will be repeated automatically as long as the command is active. 'Auto Change': If there is no input command, the menu changes from one item to the next. The 'Menu Navigation Timing' parameter specifies the transition time between menus.
Menu Navigation Timing	200 – 2000 ms	If 'Menu Navigation Mode' specifies 'Auto Change', this parameter specifies the time it takes to move from one menu item to the next.

1-Switch Scanner: Menu Entries Menu

Parameter	Range	Description
Settings	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Settings'. If enabled, system settings are available to the user in the Auxiliary menu.
Show Change Input device	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Change Input Device'. If enabled, the 'Change Input Device' option is available to the user in the Auxiliary menu.

Parameter	Range	Description
1-Switch Power Off	Disabled / Enabled	Enables / disables the Auxiliary menu entry '1-Switch Power Off'. If 'Enabled', the '1-Switch Power Off' option is available to the user in the Auxiliary menu.

1-Switch Scanner: Standby Select Menu

Parameter	Range	Description
Standby Select	Disabled / Enabled	'Standby Select' allows a user to operate the system without using a mode switch. The system changes to the 'Standby Select' screen if no input command was given for the programmed 'Standby Select Timeout'.
Standby Select Timeout	1 – 120 s	Defines the time after which the system changes to the 'Standby Select' screen if no valid command was given.
Standby Aux Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the Auxiliary menu. If 'Disabled', an alternative mode method has to be available.
Standby Seat Timeout	Disabled / Enabled	Enables / disables the 'Standby Select' function for the seat screen. If 'Disabled', an alternative mode method has to be available.

1-Switch Scanner: Sleep Menu

Parameter	Range	Description
Sleep Timeout	0 – 240 min	Defines the time that elapses after the last command is given before the system enters the 'Sleep Power Mode'.
Sleep Power Mode	Disabled / Enabled	If 'Enabled', the display will go dark when 'Sleep Timeout' has elapsed or 'Sleep Power Mode' has been executed. To wake up the system with a Head Input Device, a left-right-left command must be given. Any command will wake up the system with any other input device. If 'Disabled', this function is not available.

1-Switch Scanner: Latch Driving Menu

Parameter	Range	Description
Latch Driving Visibility	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Latch Driving'. If 'Enabled', the option to enable / disable latch for configured latch drive profiles is available to the user in the Auxiliary menu

1-Switch Scanner: User Speed Adjust Menu

Parameter	Range	Description
User Speed Adjust	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Speed Adjust'. If 'enabled', the 'Speed Adjust' option is available to the user in the Auxiliary menu.
Drive 1	0 – 10	If 'User Speed Adjust' is 'Enabled', the user has the ability to adjust the speed of each drive profile in steps of 10% (0 – 10) in the Auxiliary menu. If 'User Speed Adjust' is 'Disabled', the settings of 'Speed Adjust' are disregarded and the settings of the corresponding drive profile are taken.
Drive 2	0 – 10	Same as Drive 1.
Drive 3	0 – 10	Same as Drive 1.
Drive 4	0 – 10	Same as Drive 1.

1-Switch Scanner: Auto Shutoff Menu

Parameter	Range	Description
Auto Shutoff	0 – 240 min	Defines the time that elapses before the system powers down after the last input command. A power on command by the user will restart the system. Use this parameter to save battery capacity. **Note:** A setting of 0 minutes disables Auto Shutoff.

Bluetooth Parameters

The following sections describe the Bluetooth parameters.

- Bluetooth: Mouse Menu
- Bluetooth: Assistive Switch Control Menu
- Bluetooth: Joystick Menu

Bluetooth: Mouse Menu

Parameter	Range	Description
Mouse	Disabled / Enabled	Enables / disables Bluetooth 'Mouse' connectivity. If 'Enabled', 'Mouse' is available to the user in the Auxiliary menu.

Parameter	Range	Description
Mouse Clicks		• 'Switches': Use external switches from base to activate left and right mouse buttons. • 'Base Toggle': Use external left mouse switch from base to toggle between mouse movement and mouse clicks. • 'Base Auto': Same as 'Base Toggle' but automatically returns back to mouse move after click. • 'Base Hold': Same as 'Base Toggle' but mouse clicks are only active as long as button is being held. • 'Mode Toggle': Use mode switch to toggle between mouse movement and mouse clicks. * • 'Mode Auto': Same as 'Mode Toggle' but automatically returns back to mouse move after click. * • 'Mode Hold': Same as 'Mode Toggle' but mouse clicks are only active as long as button is being held. * • 'Double Left Toggle': Use double left command to toggle between mouse movement and mouse clicks. ** • 'Double Right Toggle': Use double right command to toggle between mouse movement and mouse clicks. ** • 'Double Left Auto': Same as 'Double Left', but returning automatically back to mouse movement. ** • 'Double Right Auto': Same as 'Double Right', but returning automatically back to mouse movement. ** • 'Dwell': After a dwell time the screen toggles automatically between mouse movement and mouse clicks. The 'Dwell' time is defined with the 'Device Long Command Time'. * If Mode command is used to change between mouse movement and mouse click, an alternative mode option has to be available. ** If Double command is used to change between mouse movement and mouse click, an alternative mode option has to be available. *** If a Hand Control with light keys is used, the turn indicator buttons are used instead.

Parameter	Range	Description
Dwell Time	200 – 10000 ms	If the 'Mouse Clicks' option 'Dwell' is selected, the mouse screen changes automatically from the Mouse Move screen to the Mouse Click screen if the mouse cursor was not moved for the 'Dwell Time'. The 'Dwell Time' starts after the mouse movement command is released. After a click option was selected, the screen changes automatically back to the move screen. A double left click is executed when the left click is operated twice within the 'Double Command Time' of the active input device. To return to the mouse move screen without executing a click option, operate the 'Return' option in the mouse click screen. If 'Return' is operated twice within the 'Double Command Time' of the active input device, the Bluetooth screen is left as if a 'Mode' command was given. **Note:** For '2-Switch' and 'Sip & Puff' set to '2 Pressure' the 'Right Click' has to be operated twice within the 'Double Command Time' of the active input device to exit the Bluetooth screen.
Mouse Command Scaling	10 – 100 %	Defines the mouse pointer speed.

Bluetooth: Assistive Switch Control Menu

Parameter	Range	Description
Assistive Switch Control	Disabled / Enabled	Enables / disables the Bluetooth 'Assistive Switch Control' connectivity. If 'enabled', 'Assistive Switch Control' is available to the user in the Auxiliary menu.

Bluetooth: Joystick Menu

Parameter	Range	Description
Joystick	Disabled / Enabled	Enables / disables Bluetooth 'Joystick' connectivity. If 'Enabled', 'Joystick' is available to the user in the Auxiliary menu. **Note:** 'Joystick' is not available for 1-Switch and 2-Switch input devices. If a 1-Switch or 2-Switch input device is configured, 'Joystick' will not be available to the user in the Auxiliary menu.

Seat Parameters

The Seat parameters are for general seat navigation, memory seating options and enabling specific seat functions.

- Seat: Seat Settings Menu
- Seat: Memory Seating Setup Menu
- Seat: Actuator Angle Settings Menu
- Seat: Floor Collision Settings Menu
- Seat: Memory Position 1 To 8 Menu
- Seat: Calibration Values Menu
- Seat: Anterior Tilt Position Menu
- Seat: Actuator Memory Position Menu
- Seat: Seat Demo Mode Menu

Related information

Seat Configuration

Seat: Seat Settings Menu

Parameter	Range	Description
Total Back Angle Head Control	10 – 180°	Defines the angle beyond which a Head Input Device will be changed from 3-, 4- or 5-Way operation to 2-Way operation (left and right command). This is necessary because the user might not be able to operate the center command in a tilted position.
Seat Head Left / Right Swap	No / Yes	Swaps left and right head switches in seat if set to 'Yes'. For instance, it may be more convenient for the user to operate the 'Device Double Command' on the opposite pad to change through seat functions.
Latch Cancel	Disabled / Enabled	Defines how a latched seat function can be stopped. 'Enabled': Any switch or input command will stop the seat function. 'Disabled': Only the switch or input command which started the seat function is able to stop the seat function.
Cutout Inhibit Time	100 – 2000 ms	Defines for how long the seat actuator current cutout is inhibited. This can be adjusted to prevent unintentional actuator stop due to increased actuator current during start and acceleration phase.
Seat Enable While Driving	No / Yes	Defines if seat actuator operation via ESM module or mapped input / outputs is enabled or disabled while driving (parameter settings 'Yes, No').

Parameter	Range	Description
Seat Type	Standard or Asymmetrical elevate	Configures the available seating system. This parameter must be set correctly. Misconfiguration leads to limited seating system operation.

Seat: Memory Seating Setup Menu

Parameter	Range	Description
Memory Seating	Disabled / Enabled	Enables / disables the memory seating functionality.
Tilt Home Offset	Range –5 to +5	Defines the tilt home position at which the tilt forward function stops. Forward tilt commands beyond this offset will have no effect.
Memory Seating Latch Timeout	0 – 255 s	Defines the time the seat will continue to move latched without input command. After 'Memory seating latch timeout' expires, the seat will come to a stop if no input command was given during the 'Memory seating latch timeout' period.
Feedback Drift Warning Level	1 – 5%	Defines the drift level, in percent, where a feedback drift below 'Feedback drift warning level' is considered to be acceptable. A feedback drift above 'Feedback drift warning level' and below 'Feedback drift error level' is considered to be acceptable. In this case a feedback drift warning is issued.
Feedback Drift Error Level	3 – 10%	Defines the drift level, in percent, where a feedback drift above 'Feedback drift error level' is considered to be out of range. In this case a feedback drift error is issued.
Min Actuator Stroke Length	0 – 100%	Defines the minimum stroke length that each actuator must reach during the calibration process for the calibration to be valid.
Min Actuator Travel Time	0 – 25000 ms	Defines the minimum travel time that each actuator must reach during the calibration process for the calibration to be valid.
Asymmetrical Maximum Elevate	25 – 400%	This parameter applies to an elevate application with asymmetric actuators, where the tilt and anterior tilt actuators have different stroke lengths. This setting determines how far the longer actuator must extend when the shorter one is fully extended, ensuring the system reaches its maximum possible elevate position. Setting this value correctly is essential for achieving a smooth and level elevation motion.

Seat: Actuator Angle Settings Menu

Parameter	Range	Description
Tilt Angle Minimum Position	0 – 49°	Sets the minimum tilt angle when the tilt actuator is fully retracted.
Posterior Tilt Angle Maximum Position	0 – 180°	Sets the maximum posterior tilt angle when the tilt actuator is fully extended.
Anterior Tilt Angle Maximum Position	–90 – 180°	Sets the maximum anterior tilt angle when the anterior tilt actuator is fully extended.
AFP Elevation Angle Minimum Position	12 – 180°	Sets the minimum AFP elevation angle when the AFP elevation actuator is fully retracted.
AFP Elevation Angle Maximum Position	0 – 90°	Sets the maximum AFP elevation angle when the AFP elevation actuator is fully extended.
Recline Angle Minimum Position	0 – 167°	Sets the minimum recline angle when the recline actuator is fully retracted. This value is set during the calibration process.
Recline Angle Maximum Position	90 – 180°	Sets the maximum recline angle when the recline actuator is fully extended. This value is set during the calibration process.

Seat: Floor Collision Settings Menu

Parameter	Range	Description
Tilt / Elevate Low Position	0 – 1	Tilt / elevate position that is set during the 'Teach tilt / elevate vs. AFP articulation' function.
AFP Articulation Low Position	0 – 1	AFP articulation position that is set during the 'Teach tilt / elevate vs. AFP articulation' function.
Tilt / Elevate Up Position	0 – 1	Tilt / elevate position that is set during the 'Teach tilt / elevate vs. AFP articulation' function.
AFP Articulation Out Position	0 – 1	AFP articulation position that is set during the 'Teach tilt / elevate vs. AFP articulation' function.
Posterior Angle Ratio Disable	0 – 100%	The angle of posterior tilt when the elevate down / AFP articulate out seat function restrictions will be ignored due to footplates not able to contact the ground.
AFP Elevation Angle Ratio Disable	0 – 100%	The angle of AFP elevation when the tilt / elevate down / AFP articulate out seat function restrictions will be ignored due to footplates not able to contact the ground.

Seat: Memory Position 1 To 8 Menu

Note:

The parameters for the memory positions are identical.

Parameter	Range	Description
Memory Position	Disabled / Enabled	Enables / disables ‘Memory position x’. If ‘enabled’, the ‘Memory position x’ seat screen will be displayed.
Memory Type		Defines how 'Memory x' operates and how saved seat positions are accessed. • **Standard memory seat**: A forward input command moves the seat to the saved 'Position 1' of 'Memory x'. • **Standard memory seat with home**: ◦ A forward input command moves the seat to the saved 'Position 1' of 'Memory x'. ◦ A reverse input command moves the seat to the saved 'Seat home position'. • **2-stage memory seat**: ◦ A forward input command moves the seat to the saved 'Position 1' of 'Memory x'. Once 'Position 1' is reached, the seat stops. ◦ A second forward input command moves the seat to the saved 'Position 2'. • **2-stage memory seat with home**: ◦ A forward input command moves the seat to the saved 'Position 1' of 'Memory x'. Once 'Position 1' is reached, the seat stops. ◦ A second forward input command moves the seat to the saved 'Position 2'. ◦ A reverse input command moves the seat to the saved 'Seat home position'. • **2-way memory seat**: ◦ A forward input command moves the seat to the saved 'Position 1' of 'Memory x'. ◦ A reverse input command moves the seat to the saved 'Position 2'.
Latch	Disabled / Enabled	Enables / disables the ‘Latch’ functionality for ‘Memory x’. If ‘enabled’, the memory positions of ‘Memory x’ will move latched if operated.

Parameter	Range	Description
User Adjustable	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Save memory positions'. If 'enabled', 'Memory forward / reverse' is available to the user in the Auxiliary menu for 'Memory x'.
Memory Position Speed Factor	0.5 – 2	Sets the speed factor for 'Memory x' that will be applied when the memory position is operated.
Emergency Position	Disabled / Enabled	Enables / disables the property 'Emergency position'. If 'enabled', the memory position of 'Memory x' is defined as an emergency position.
Anterior Tilt Allowed	Disabled / Enabled	Enables / disables the property 'Anterior tilt allowed'. If 'enabled', the memory position of 'Memory x' can be set as an anterior tilt position by running the 'Save memory position' function.
Memory Position Text		Allows a memory position to be named. Maximum 15 characters.

Seat: Calibration Values Menu

Parameter	Range	Description
Status	Valid / Invalid	Indicates whether the calibration values of the actuator are 'Valid' or 'Invalid'.
Position Start	0 – 1	Retracted absolute position of the actuator. This value is set during the calibration process.
Position Stop	0 – 1	Extended absolute position of the actuator. This value is set during the calibration process..
Travel Time In (ms)	0 – 120000 ms	Time the actuator needs to fully retract from a fully extended position. This value is measured and set during the calibration process.
Travel Time Out (ms)	0 – 120000ms	Time the actuator needs to fully extend from a fully retracted position. This value is measured and set during the calibration process.
Actuator ID		ID of calibrated actuator.

Seat: Anterior Tilt Position Menu

Parameter	Range	Description
Actuator 1 ID		ID of actuator 1 for the save memory position.

Parameter	Range	Description
Actuator 1 Position	0 – 1	Position of actuator 1 for the saved memory position.
Actuator 2 ID		ID of actuator 2 for the save memory position.
Actuator 2 Position	0 – 1	Position of actuator 2 for the saved memory position.
Actuator 3 ID		ID of actuator 3 for the save memory position.
Actuator 3 Position	0 –1	Position of actuator 3 for the saved memory position.
Actuator 4 ID		ID of actuator 4 for the save memory position.
Actuator 4 Position	0 – 1	Position of actuator 4 for the saved memory position.
Actuator 5 ID		ID of actuator 5 for the save memory position.
Actuator 5 Position	0 – 1	Position of actuator 5 for the saved memory position.
Actuator 6 ID		ID of actuator 6 for the save memory position.
Actuator 6 Position	0 – 1	Position of actuator 6 for the saved memory position.
Actuator 7 ID		ID of actuator 7 for the save memory position.
Actuator 7 Position	0 – 1	Position of actuator 7 for the saved memory position.
Actuator 8 ID		ID of actuator 8 for the save memory position.
Actuator 8 Position	0 – 1	Position of actuator 8 for the saved memory position.
Actuator 9 ID		ID of actuator 9 for the save memory position.
Actuator 9 Position	0 – 1	Position of actuator 9 for the saved memory position.
Actuator 10 ID		ID of actuator 10 for the save memory position.
Actuator 10 Position	0 – 1	Position of actuator 10 for the saved memory position.

Seat: Actuator Memory Position Menu

Parameter	Range	Description
Actuator 1 ID		ID of actuator 1 for the save memory position.
Actuator 1 Position	0 – 1	Position of actuator 1 for the saved memory position.
Actuator 2 ID		ID of actuator 2 for the save memory position.
Actuator 2 Position	0 – 1	Position of actuator 2 for the saved memory position.
Actuator 3 ID		ID of actuator 3 for the save memory position.
Actuator 3 Position	0 –1	Position of actuator 3 for the saved memory position.

Parameter	Range	Description
Actuator 4 ID		ID of actuator 4 for the save memory position.
Actuator 4 Position	0 – 1	Position of actuator 4 for the saved memory position.
Actuator 5 ID		ID of actuator 5 for the save memory position.
Actuator 5 Position	0 – 1	Position of actuator 5 for the saved memory position.
Actuator 6 ID		ID of actuator 6 for the save memory position.
Actuator 6 Position	0 – 1	Position of actuator 6 for the saved memory position.
Actuator 7 ID		ID of actuator 7 for the save memory position.
Actuator 7 Position	0 – 1	Position of actuator 7 for the saved memory position.
Actuator 8 ID		ID of actuator 8 for the save memory position.
Actuator 8 Position	0 – 1	Position of actuator 8 for the saved memory position.
Actuator 9 ID		ID of actuator 9 for the save memory position.
Actuator 9 Position	0 – 1	Position of actuator 9 for the saved memory position.
Actuator 10 ID		ID of actuator 10 for the save memory position.
Actuator 10 Position	0 – 1	Position of actuator 10 for the saved memory position.

Seat: Seat Demo Mode Menu

Parameter	Range	Description
Seat Demo Mode	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'Seat demo mode'. If enabled, seat demo mode is available to the user in the Auxiliary menu.
Pause Time Minutes	0 – 59 mins	Time that the system waits after reaching a memory position during seat demo mode.
Pause Time Seconds	0 – 59 s	Time that the system waits after reaching a memory position during seat demo mode.
1st Memory Position	Disabled / Memory Position 1 to 8	Defines the first memory position for the seat demo mode.
2nd Memory Position	Disabled / Memory Position 1 to 8	Defines the second memory position for the seat demo mode.

Environmental Control Module Parameters

The following sections describe the Environmental Control Module parameters.

- ECM: ECM Settings Menu
- ECM: Function Configuration Menu

ECM: ECM Settings Menu

Parameter	Range	Description
ECM Enable	Disabled / Enabled	Enables / disables the Auxiliary menu entry 'ECM'. If 'Enabled', and if at least one ECM function is configured and enabled for visibility, the 'ECM' entry is available to the user in the Auxiliary menu.
Com. Device Output Time	200 – 2000 ms	Defines the minimum output time of an ECM function operated over the 'Com. Device' screen.

ECM: Function Configuration Menu

Parameter	Range	Description
Function Visibility	Disabled / Enabled	Enables / disables the ECM function visibility in the Auxiliary menu. If 'Enabled', and if the ECM function is configured, the ECM function is available to the user in the Auxiliary menu.
Function Name		Defines the user specific text for the ECM function.

Parameter	Range	Description
Function Type		Defines the ECM function type. 'Hold': The ECM function is active as long as the input device is operated. 'Toggle (On / Off)': The ECM function is toggled with each input command between active and non-active depending on the current state of the ECM function. 'Com. Device': Enables the "Communication Device" screen in the Auxiliary menu. The 'Com. Device' is operated as a 'Hold' function. '4-Way Screen': Enables the '4-Way Screen' in the Auxiliary menu. The '4-Way Screen' has a fixed relay output assignment (FWD=R1 / RIGHT=R2 / REV=R3 / LEFT=R4) and is operated as a 'Hold' function. '8-Way Screen': Enables the '8-Way Screen' in the Auxiliary menu. The '8-Way Screen' has a fixed relay output assignment (FWD=R1 / FWD-RIGHT=R1+R2 / RIGHT=R2 / REV-RIGHT=R2+R3 / REV=R3 / REV-LEFT=R3+R4 / LEFT=R4 / FWD-LEFT=R1+R4) and is operated as a 'Hold' function.
Relay Outputs		Defines which relay outputs will be set active with the ECM function.
Clear Outputs		Defines which relay outputs will be set inactive with the ECM function.

System Parameters

The following sections describe the System parameters.

- System: Motor Menu
- System: Servo Menu
- System: Encoders Menu
- System: Chair Type Menu
- System: Stability Control Menu
- System: Limit Settings Menu
- System: Steering Limit Menu
- System: Shaping Settings Menu
- System: Chair Drive Profile Menu
- System: Chair Drive Limits Menu
- System: Chair Base Inclination Menu
- System: Wheel Settings Menu

- System: Brake Settings Menu
- System: Miscellaneous Menu
- System: Motor Load Compensation Menu
- System: Charger Menu

System: Motor Menu

MANDATORY:

The motor settings must be configured to match motor manufacturer specifications for proper speed calculation and a motor resistance for safe system compensation.

Parameter	Range	Description
Motor Current Limit	120 A	Defines the maximum current, in Amperes, that the controller will supply during both drive and regenerating operation. This parameter can be limited to protect the motor from excessive (potentially damaging) currents or to reduce the maximum torque applied to the drive system by the motor.
Motor Current Foldback Threshold	45 – 120 A	After the Power Base has supplied current over the 'Motor Current Foldback Threshold' for the configured 'Motor Current Limit Time', then the current is reduced to the 'Motor Current Foldback' setting for the 'Motor Current Foldback Time'. **Note:** The Power Base may limit the current to protect itself before the 'Motor Current Limit Time' is reached.
Motor Current Limit Time	0 – 100 s	After the Power Base has supplied current over the 'Motor Current Foldback Threshold' for the configured 'Motor Current Limit Time', the current is reduced to the 'Motor Current Foldback' setting for the 'Motor Current Foldback Time'. **Note:** The Power Base may limit the current to protect itself before the 'Motor Current Limit Time' is reached.
Motor Current Foldback	20 – 120 A	After the Power Base has supplied current over the 'Motor Current Foldback Threshold' for the configured 'Motor Current Limit Time', then the current is reduced to the 'Motor Current Foldback' setting for the 'Motor Current Foldback Time'. **Note:** The Power Base may limit the current to protect itself before the 'Motor Current Limit Time' is reached.

Parameter	Range	Description
Motor Current Foldback Time	10 – 500 s	After the Power Base has supplied current over the 'Motor Current Foldback Threshold' for the configured 'Motor Current Limit Time', then the current is reduced to the 'Motor Current Foldback' setting for the 'Motor Current Foldback Time'. **Note:** The Power Base may limit the current to protect itself before the 'Motor Current Limit Time' is reached.
Motor Limit Hold Current	0 – 100 A	Defines the maximum start current the controller supplies to the motors after releasing the brakes when the chair has stopped under high load with high hold currents. Limiting this current reduces the risk of the chair making a jerky movement if the obstacle / load is removed before giving a new input command. Limiting this current could on the other hand cause a worse roll-back behavior in hill hold conditions since the control loop needs to build up additional hold current off the 'Motor Limit Hold Current' level. A reasonable setting is at 40% to 60% of the 'Motor Current Limit'.
Motor Stall Detection	Disabled / Enabled	Defines whether motor blocking (e.g., at a curb) is supervised by setting the parameter to 'Enabled', or not if set to 'Disabled'. The parameters 'Stall Current Threshold' and 'Stall Time Threshold' define when the motor is detected as stalled.
Motor Stall Current Threshold	20 – 120 A	Defines the current threshold at which the motor stall condition is detected. After the Power Base has supplied current over the 'Motor Stall Current Threshold' for the 'Motor Stall Time Threshold' and the motor speed was lower than 'Motor Stall Speed Threshold', then the chair comes to a safe stop and the brakes engage.
Motor Stall Time Threshold	0 – 20 s	Defines the time threshold at which the motor stall condition is detected. After the Power Base has supplied current over the 'Motor Stall Current Threshold' for the 'Motor Stall Time Threshold' and the motor speed was lower than 'Motor Stall Speed Threshold', then the chair comes to a safe stop and the brakes engage.
Motor Stall Speed Threshold	20 – 500 rpm	Defines the speed threshold, in RPM at the motor rotor, at which the motor stall condition is detected. After the Power Base has supplied current over the 'Motor Stall Current Threshold' for the 'Motor Stall Time Threshold' and the motor speed was lower than the programmed 'Motor Stall Speed Threshold', then the chair comes to a safe stop and the brakes engage.

Parameter	Range	Description
Motor Max Resistance	5 – 1000 mΩ	Defines the upper motor terminal resistance, in mΩ, for situations where the chair is blocked under high load (e.g., at curbs where the motors cause a short to the PB outputs and 'Motor Current Limit' could be reached). The purpose of this parameter is to apply a speed estimation feedback correction if driving without encoders. This parameter is not used for stall detection or other purposes. For proper determination of the setting, the 'PB Resistance M1/ M2' shall be monitored for that specific high load situations, ideally while the chair is at normal operation temperature (whether cold nor hot). To be effective, the setting is normally 30–80 % higher than the characteristic 'Motor Resistance'. To switch the speed estimation feedback correction off, the parameter shall be set to a value equal or lower than the 'Motor Resistance'. Setting this parameter too high may cause jerky, uncomfortable chair operation under load at low speeds.
Motor Resistance	5 – 1000 mΩ	Defines the motor terminal resistance in mΩ. The setting is used for speed estimation and control feedback. It should be set to the nominal motor reactance. Setting this parameter to a lower value reduces aggressive control and precision. Setting this parameter higher than the actual resistance may cause jerky, uncomfortable or even unsafe chair operation.
Motor Resistance Calibrated	20 – 300 mΩ	Indicates the motor terminal resistance measured and saved by the 'Motor Resistance Calibration' function. The parameter is individual per motor and further manually configurable by OEM. The 'Motor Resistance Calibrated' is required for motion estimator based driving without encoders and to supervise the encoder speed feedback if driving with encoders. **MANDATORY:** The calibration function must be conducted to assure the correct values for the chair, initially or upon motor replacement.
Motor Ke	1 – 1000	The Motor Ke parameter defines the 'back emf constant' or 'voltage constant' of the drive motor. This parameter is used for the speed estimation and the feedback control.
Motor Max. Idle RPM	100 – 6000 rpm	Defines the maximum rotor-speed of the drive motor, with gear, under no load, when nominal voltage of 24V is applied. This parameter is relevant for speed calculation by the control algorithm.
Motor Gear Ratio	1.0 – 50.0	Defines the ratio between wheel and motor rotor RPM. The motor spins by this ratio faster than the wheel.

Parameter	Range	Description
Motor Polarity Inverted	No / Yes	Defines the polarity for motor M1 and M2 (reference is PB output). If this parameter is set to 'No' the standard output is used, positive motor voltage = forward driving. If it is set to 'Yes', the polarity is swapped to positive voltage = reverse driving. **MANDATORY:** After changing this parameter the driving direction of the wheelchair must be verified while the chair is jacked / driving wheels are off ground.
Motor Swap	No / Yes	Offers the possibility to mechanically swap the motors. Motor M1 becomes motor M2 (reference is PB output) and vice versa. **MANDATORY:** After changing this parameter the driving direction of the wheelchair must be verified while the chair is jacked / driving wheels are off ground.

System: Servo Menu

Parameter	Range	Description
Enable Servo	Yes / No	Enables the servo functionality. The servo functionality must be 'Disabled' when no servo module is present. Otherwise drive will be inhibited and an error will be displayed. If a servo module is present but servo functionality is disabled, only light functions of the servo module will be functional. **Note:** Make sure that the parameters under 'Wheel settings' are set correctly. Otherwise, the calculated servo angles will not be correct and drive behavior will be negatively affected.
Servo Homing	On / Off	Enables / disables the automatic servo homing functionality. If set to 'Enabled' the servo wheels will automatically move back to their home position when one of the following conditions occurs: • When the input device is released and the chair comes to a stop. • During power up. If set to 'Disabled' the servo wheels will remain in their actual position until the next drive command is issued.
Servo 1 Home position	0 – 1	Adjusts the angle value of the servo 1 feedback referring to the absolute straight forward position of the servo 1. The correct value must be determined by manually changing the respective parameter. The value depends on the servo sensor pickup and is likely to be different for any sensor (servo 1 / servo 2).

Parameter	Range	Description
Servo 2 Home position	0 – 1	Adjusts the angle value of the servo 2 feedback referring to the absolute straight forward position of the servo 2. The correct value must be determined by manually changing the respective parameter. The value depends on the servo sensor pickup and is likely to be different for any sensor (servo 1 / servo 2).
Servo 1 feedback polarity inverted	Yes / No	Defines the polarity of the servo 1 feedback. Depending on the sensor wiring, sensor mounting and the mechanical linkage between the servo motor and the sensor, the polarity of the sensor feedback may need to be inverted. If the servo motor starts to oscillate, the polarity of the servo motor and the servo feedback are misaligned. In this case invert the polarity of the servo feedback and check for correct operation. **WARNING:** After changing this parameter the driving direction of the wheelchair must be verified while the chair is jacked / driving wheels are off ground. **Note:** The servo 1 assembly is located on the left side of the wheelchair (when looking forward). The servo 1 motor is plugged into the output A1 and the servo 1 feedback is plugged into the feedback input IN-A of the SM2L.
Servo 2 feedback polarity inverted	Yes / No	Defines the polarity of the servo 2 feedback. Depending on the sensor wiring, sensor mounting and the mechanical linkage between the servo motor and the sensor, the polarity of the sensor feedback may need to be inverted. If the servo motor starts to oscillate, the polarity of the servo motor and the servo feedback are misaligned. In this case invert the polarity of the servo feedback and check for correct operation. **WARNING:** After changing this parameter the driving direction of the wheelchair must be verified while the chair is jacked / driving wheels are off ground. **Note:** The servo 2 assembly is located on the right side of the wheelchair (when looking forward). The servo 2 motor is plugged into the output A2 and the servo 2 feedback is plugged into the feedback input IN-B of the SM2L.

Parameter	Range	Description
Servo 1 motor polarity inverted	Yes / No	Defines the polarity of the servo 1 motor. If this parameter is set to 'No' the standard output is used (positive motor voltage = clockwise rotation). If it is set to 'Yes' the polarity is swapped (positive voltage = counterclockwise rotation). **WARNING:** After changing this parameter the driving direction of the wheelchair must be verified while the chair is jacked / driving wheels are off ground. **Note:** The servo 1 assembly is located on the left side of the wheelchair (when looking forward). The servo 1 motor is plugged into the output A1 and the servo 1 feedback is plugged into the feedback input IN-A of the SM2L.
Servo 2 motor polarity inverted	Yes / No	Defines the polarity of the servo 2 motor. If this parameter is set to 'No' the standard output is used (positive motor voltage = clockwise rotation). If it is set to 'Yes' the polarity is swapped (positive voltage = counterclockwise rotation). **WARNING:** After changing this parameter the driving direction of the wheelchair must be verified while the chair is jacked / driving wheels are off ground. **Note:** The servo 2 assembly is located on the right side of the wheelchair (when looking forward). The servo 2 motor is plugged into the output A2 and the servo 2 feedback is plugged into the feedback input IN-B of the SM2L.
Servo Stall Time Threshold	0.1 – 2s	Defines the time threshold at which the servo stall condition is detected. After the servo module has supplied current over the 'Servo stall current threshold' for the 'Servo stall time threshold' the chair comes to a safe stop and the brakes engage.
Servo Stall Current Threshold	1 – 20A	Defines the current threshold at which the servo stall condition is detected. After the servo module has supplied current over the 'Servo stall current threshold' for the 'Servo stall time threshold' the chair comes to a safe stop and the brakes engage.
Sensor Calibration	Auto run	Calibrates the servo sensors

System: Encoders Menu

WARNING:

The encoder settings must be configured properly to match the encoder manufacturer specification. If not, the encoder supervision will detect this and ignore encoder feedback, and a warning will be shown on the main display.

Parameter	Range	Description
Motor Encoders Enabled	No / Yes	If the drive motors are equipped with quadrature encoders, enable this feature by setting to 'Yes'. Be aware that the 'Motor Encoder Pulses Per Rev.' setting has to be set correctly to match the encoder product specification.
Motor Encoders Pulses per Rev.	10 – 256	Defines the revolution rate of the drive motor encoders. This value must be verified with the encoder product specification. The higher the revolution, the more accurately the chair will behave at low speed. 60 or more pulses per revolution are required. The system supports up to 256 pulses per revolution at a motor rotor speed of 5500 RPM.
Motor Encoder Inverted	No / Yes	Makes it possible to invert the encoder polarity. This may be required if the encoder wiring was changed. Forward encoder information becomes reverse information and vice versa. **MANDATORY:** After changing this parameter the driving direction of the wheelchair must be verified with the chair being jacked / driving wheels off ground.

System: Chair Type Menu

Parameter	Range	Description
Wheelchair Type	Front Wheel / Mid Wheel / Rear Wheel	Configures the chair type as a precondition to use stability control settings, if applicable. This parameter must be set according to the chair base. Misconfiguration leads to a speed reduction warning and rescue drive mode.

System: Stability Control Menu

Parameter	Range	Description
Stability Control Technology	None / Gyro	Disables (None) or enables 'Gyro' as drive stabilizing technology, which is required for front wheel drive chairs.
Gyroscope Drive Profile (1-4)	On / Off	Enable 'On' or disable 'Off' gyro based stability control for drive 1.
Gyro Supervision Level	0 - 2	Adjusts how closely the system monitors the gyro. A lower setting provides tighter supervision with quicker fault detection, while a higher setting allows for looser supervision with more tolerance

Parameter	Range	Description
Gyro Softening	0 - 1	This parameter influences the gyro reactivity. A smaller value has less influence making the drive behavior more aggressive. A larger value has more influence making the drive behavior softer.
Speed Reduction In Turns	0 – 1	Limits the speed in a turn for front wheel drive chairs, if the stability control is enabled. Increasing the setting amplifies this effect, reducing it makes the wheel chair more agile / performant.
Accel Reduction Out Of Turns	0 – 1	Limits the acceleration coming out of a turn for front wheel drive chairs, if the stability control is enabled. Increasing the setting amplifies this effect, reducing it makes the wheel chair more agile / performant.
Decel Increase Into Turns	0 – 1	Increases the deceleration going into a turn for front wheel drive chairs, if the stability control is enabled. Increasing the setting amplifies this effect. When reducing it the wheel chair adjusts more slowly to the 'Speed Reduction In Turns'.
Traction Loss Control	0 – 1	At higher settings, the ability of the chair to regain traction in case a wheel slips or spins freely is increased. This parameter shall only be tuned in if the general drive setup was accomplished (User drive profiles, Shaping settings, Stability control).
Proportional Tracking Control	0 – 1	This parameter is only effective with a proportional input device. At higher settings, the chair is increasingly supported by gyro for tighter tracking to follow the input trajectory. At higher settings, the chair tends to become more responsive to directional inputs. This parameter shall only be tuned in if the general drive setup was accomplished (User drive profiles, Shaping settings, Stability control).

System: Limit Settings Menu

Note:

Limit Settings determine the maximum achievable drive and turn speed, as well as the User Drive Profile limits. They must be tuned to match the maximum speeds desired and to ensure safe profile tuning adjustments for dealers.

Parameter	Range	Description
Drive Max Speed	5 – 100 %	Defines the maximum possible chair speed based on motor RPM and gear ratio. The value of this parameter rescales the individual forward and reverse speed settings for all drive profiles. **Example**: 'Drive Max Speed' = 60%, 'Fwd Max Speed' in Drive Profile 4 = 80%, Resulting maximum forward speed = 0.6 x 0.8 = 48% of the maximum possible forward speed.
Drive Max Turn	5 – 100 %	Defines the maximum possible chair turn speed based on motor RPM and gear ratio. The value of this parameter rescales the individual turn speed settings for all drive profiles. **Example**: 'Drive Max Turn' = 75%, 'Turn Max Speed' in Drive Profile 4 = 90%, Resulting maximum turn speed = 0.75 x 0.9 = 67.5% of the maximum possible turn speed.
Profile Fwd Accel Limit	5 – 100 %	Sets the limit at which a user with a lower programming access level can configure the related drive profile setting. For example, if a user with the OEM access level specifies 50% for Profile Fwd Decel Limit, then a user with the Dealer access level cannot specify a forward deceleration limit greater than 50%. The limit applies to all drive profiles. If the limit is lowered, previously higher settings in profiles are limited accordingly.
Profile Fwd Decel Limit	5 – 100 %	
Profile Fwd Speed Limit	5 – 100 %	
Profile Rev Accel Limit	5 – 100 %	
Profile Rev Decel Limit	5 – 100 %	
Profile Rev Speed Limit	5 – 100 %	
Profile Turn Accel Limit	5 – 100 %	
Profile Turn Decel Limit	5 – 100 %	
Profile Turn Speed Limit	5 – 100 %	

System: Steering Limit Menu

Parameter	Range	Description
V25 – Steering Limit	0 – 100 %	The steering limit parameters V25, V50, V75 and V100 restrict the turn rate (turn speed) for the four absolute chair speeds.
V50 – Steering Limit	0 – 100 %	
V75 – Steering Limit	0 – 100 %	
V100 – Steering Limit	0 – 100 %	

System: Shaping Settings Menu

MANDATORY:

Shaping settings must be tuned to ensure safe driving in turns at maximum possible forward and turn speeds, so that traction is always maintained.

Parameter	Range	Description
Velocity Turn KShape	0.00 – 1.00	This parameter defines the amplitude/strength of the shaping function, which reduces the vehicle speed in turns. A value of 1:00 (maximum value) equals factor 0.5 on the possible vehicle speed in the direction where the 'Velocity Turn Shape Phase' angle is set. Away from the phase angle, but within the 'Velocity Turn Shape Sector' angle, the speed reduction fades out towards zero. This setting depends on the chair type and user weight.
Velocity Turn Shape Sector	0 – 90°	This parameter defines the sector within which the velocity / turn shaping function reduces vehicle speed in turns. The sector angle has to entirely fit into the forward / right quadrant. The sector middle (half of the sector angle) is where the 'Velocity Turn Shape Phase' is set. The sector defined is applied to all four quadrants of the input commands. The phase angle plus / minus half of the sector angle shall not exceed the forward / right quadrant. This setting depends on the chair type and user weight.
Velocity Turn Shape Phase	0 – 90°	This parameter defines the phase angle, measured from 12 o'clock to 3 o'clock (forward / right quadrant) over which the sector angle is centrally placed. The phase angle plus / minus half of the sector angle shall not exceed the forward / right quadrant. This setting depends on the chair type and user weight.

Parameter	Range	Description
Velocity Turn Reactivity	0.00 – 1.00	This parameter increases the vehicle reactivity to turn commands at higher speeds. Maximum effect is when the setting is 1, no effect at 0. This setting depends on the chair type and user weight.
Switched Turn Drive 1	20 – 50°	Defines the input trajectory angle for all drive 1 profiles of switched input devices or proportional input devices configured to operate switched. **Example for setting of 35°**: Forward + left for switched operation equals 35° degrees of a proportional input, resulting in the respective turning arc. All diagonal directions forward / reverse, left / right use the same angle symmetrically, measured against the forward / reverse axis.
Switched Turn Drive 2	20 – 50°	Same as 'Switched Turn Drive 1,' but for Drive 2.
Switched Turn Drive 3	20 – 50°	Same as 'Switched Turn Drive 1,' but for Drive 3.
Switched Turn Drive 4	20 – 50°	Same as 'Switched Turn Drive 1,' but for Drive 4.
Switched Turn Time	0.00 – 2.00 s	Defines the transition time for changing drive directions giving switched input commands. **Examples for a setting at 1 second:** • Forward to forward + left takes 1s • Forward + left to left takes 1s • Left to forward + left takes 1s, etc. • Left directly to forward takes 1s after passing forward + left sector (time being reset at transition through forward + left to not double up) The transition time setting does not apply if there is a direction change forward / reverse or when the input command has been released between two switch commands. In this case, the drive profile accelerates / decelerates apply.

System: Chair Drive Profile Menu

Parameter	Range	Description
Drive Quick Stop Fwd Factor	1.0 – 3.0	This parameter value is multiplied by the individual forward deceleration setting of each individual drive profile. The result is a stronger deceleration when stopping in quick stop mode. A quick stop is performed when the joystick is deflected more than 50% in the reverse direction while driving forward. **Example:** 'Drive Quick Stop Forward Factor' = 2.0, 'Fwd Max Accel' in Drive 1 = 50%. Quick stop deceleration forward = 2.0 x 50% = 100%.
Drive Quick Stop Rev Factor	1.0 – 3.0	This parameter value is multiplied by the individual reverse deceleration setting of each individual drive profile. The result is a stronger deceleration value when stopping in quick stop mode. A quick stop is performed when the joystick is deflected more than 50% in the forward direction while driving in reverse. **Example**: 'Quick Stop Factor Reverse' = 1.5, 'Rev Max Accel' in Drive 1 = 40%. Quick stop deceleration reverse = 1.5 x 40% = 60%.
Drive Emergency Stop	50 – 100 %	Defines deceleration in an emergency stop. The 'Emergency Stop' has a higher deceleration rate than the 'Quick Stop', but will not exceed 4m / s2. An 'Emergency Stop' is performed as a result of system hardware or software errors being detected, or if the system gets switched off while driving. 100% corresponds to a deceleration of 4m / s2. 'Emergency Stop' is concluded by engaging the park brake and switching the system off.
Drive Forward Tracking	–100 – 100	Adjusts the straight forward driving. It is used to compensate small differences in the motors, tires, wheels, weight, etc. Before changing 'Drive Forward Tracking', check the following factors that influence straight driving: Tire pressure, caster tension, weight distribution of the operator and ground surface. Decrease the tracking value (–) if the chair veers to the right. Increase the tracking value (+) if the chair veers to the left. Adjustment increments of 2 should be used. After you finish adjusting, retest the tracking. **Notes:** • A loose caster wheel tension will cause the casters to flutter at high speeds. If it is too tight, the wheelchair is hard to turn. • If the operator's weight is not centered, the wheelchair will veer. The chair will not drive fully straight on uneven ground.
Drive Reverse Tracking	–100 – 100	Same as 'Drive Forward Tracking,' but for Reverse.

Parameter	Range	Description
Rescue Drive Fwd Speed	5 – 40 %	Defines the speed, acceleration, and deceleration limits when the wheelchair is in 'Rescue Drive'. 'Rescue Drive' can be activated by certain warnings or errors. If these parameters are higher than the active drive profile setting, the lower value is used. **WARNING:** Make sure that the user can safely operate the wheelchair at this setting.
Rescue Drive Fwd Accel	5 – 40 %	
Rescue Drive Fwd Decel	5 – 60 %	
Rescue Drive Turn Speed	5 – 40 %	
Rescue Drive Turn Accel	5 – 40 %	
Rescue Drive Turn Decel	5 – 60 %	
Rescue Drive Rev Speed	5 – 40 %	
Rescue Drive Rev Accel	5 – 40 %	
Rescue Drive Rev Decel	5 – 60 %	
Rescue Drive Power	20 – 100 %	Limits the system drive torque output for the 'Rescue Drive' profile. If this setting is higher than the current drive profile 'Power' parameter setting, then the lower value is taken. Ensure that the user can safely operate the wheelchair at this setting.

System: Chair Drive Limits Menu

Parameter	Range	Description
Chair Drive Limit Speed (%)	0 - 100	Speed limit when the respective 'Chair drive limit' is active.
Chair Drive Limit Accel	5 – 100	Acceleration limit when the respective 'Chair drive limit' is active.
Chair Drive Limit Decel	5 – 100	Deceleration limit when the respective 'Chair drive limit' is active.

System: Chair Base Inclination Menu

Parameter	Range	Description
Connectors Facing Direction	Undefined / Connector Direction	The direction in which the connectors of the module are facing towards when the chair is driving in the forward direction. Can be Up, Down, Left, Right, Forward or Reverse.
Base Plate Facing Direction	Undefined / Base Plate Direction	The direction in which the Base Plate of the module is facing towards when the chair is driving in the forward direction. Can be Up, Down, Left, Right, Forward or Reverse.

Parameter	Range	Description
Chair Base Angle Offset	–45 to 45°	Offset that needs to be adjusted if the chair base angle cannot be calibrated.

System: Wheel Settings Menu

Parameter	Range	Description
Wheel Diameter	0.100 – 1.000 m	Defines the diameter of the drive wheels of the chair. This value must be set accurately.
Wheelbase	0.100 – 1.000 m	Defines the distance between the driving wheels and servo wheels for front- and rear-wheel drive chairs. This value is required for the angle calculation of the servo wheels and must be set correctly.
Speed Calibration	0.000 – 2.000	Allows speed indicator adjustment on enAble X1 system's drive screens. Increasing the 'Speed Calibration' value increases the indicated speed. The default factor of '1' may be slightly increased. For example, a 6mph chair indicates 5.9mph only at 100% 'Fwd Max Speed' in the drive profile, and 100% 'Drive Max Speed' in the 'Limit settings'.
Drive Wheel Distance	0.100 – 1.000 m	Defines the distance between the driving wheels (mid-tire). This value is required for the angle calculation of the servo wheels and must be set correctly.
Servo Wheel Distance	0.100 – 1.000 m	Defines the distance between the servo wheels (mid-tire). This value is required for the steering angle calculation and must be set correctly.

System: Brake Settings Menu

MANDATORY:

Brake Settings must be configured to ensure the brake always engages with the apply voltage and holds with the continuous voltage.

Parameter	Range	Description
Delay	10 – 500 ms	If the motors run below a certain RPM and no drive command is detected, the brakes will engage after the 'Delay' (in ms) expires. **Note:** 'Delay' should have a lower value than 'Safety Delay'.

Parameter	Range	Description
Safety Delay	10 – 1500 ms	Defines the delay to engage the brakes as a second criteria (subsequent to 'Delay') if no drive command is detected. For safety reasons, 'Safety Delay' is without regard of the motor RPM. **Note:** The 'Safety Delay' should have a higher value than 'Delay'.
Apply Time	100 – 2000 ms	Defines the duration (in ms) of the release pulse applied to the brakes. This pulse has to release the brakes, even if they are at maximum operating temperature. After the release pulse, the 'Continuous Voltage' is applied to the brakes.
Apply Voltage	6 – 24 V	Defines the voltage of the release pulse applied to the brakes. This pulse has to release the brakes, even if they are at maximum operating temperature. After the release pulse, the 'Continuous Voltage' is applied to the brakes.
Continuous Voltage	6 – 24 V	Defines the voltage applied to the brakes after the release pulse. This parameter should be set higher than the minimum required voltage to keep the brakes released, even if the brakes are at maximum operating temperature. 'Continuous Voltage' set to the minimum required level reduces the power consumption and the brake temperatures.

System: Miscellaneous Menu

Parameter	Range	Description
System Lock	Disabled / Enabled	Enables or disables the system to start up in a locked condition. The user is asked to unlock the system at startup before using the chair. When activating the 'System Lock' the system shall power down.
Latch Timeout Disable	No / Yes	If set to 'Yes' the 'Latch Timeout' is disabled. The chair will **not** come to a stop unless a stop command is given. **WARNING:** This parameter should not be set to 'Yes' for normal operation!
Chair Serial Number		Editable field that contains the chair serial number from production.
Seat Serial Number		Editable field that contains the seat serial number. This information is not configured in production and will be added by the provider.

Parameter	Range	Description
Provider Info Line 1		The system provides 6 editable fields for entering the provider information. Each field refers to a line on the provider information screen (HC or DM display). Provider information example and format: Line 1: Curtis Instruments, Inc. Line 2: Spare Line 3: 200 Kisco Ave Line 4: Mt Kisco, NY 10549 Line 5: 1-914-666-2971 Line 6: https://www.curtisinstruments.com/
Provider Info Line 2		
Provider Info Line 3		
Provider Info Line 4		
Provider Info Line 5		
Provider Info Line 6		

System: Motor Load Compensation Menu

Parameter	Range	Description
Motor Calibration Range Max	20 – 300 mΩ	Defines the upper limit where the measured values by the 'Motor Resistance Calibration' function are considered valid. If a measured value exceeds that limit, it is saved to the 'Motor Resistance Calibrated' settings cut back to this limit. The values configurable by the OEM may exceed this limit according to the 'Motor Resistance Calibrated' parameter range.
Motor Calibration Range Min	20 – 300 mΩ	Defines the lower limit where the measured values by the 'Motor Resistance Calibration' function are considered valid. If both motor resistance values are at or above that limit, they are saved to the 'Motor Resistance Calibrated' settings. The calibration function results are considered unsuccessful below that limit. The values configurable by the OEM may exceed this limit according to the 'Motor Resistance Calibrated' parameter range.
Motor Load Compensation Rate	60 – 100 %	**WARNING:** The setting greatly effects how the chair drives. Adjust with caution, in small increments. Before adjusting this parameter, be sure to adjust the 'User Drive Profiles' to achieve the desired drive experience. The parameter chooses the percentage of the motor load compensation that is applied to the control loop. Decreasing the default value will soften the drive reaction and result in reduced curb climb and hill hold performance. Increasing the default value will make the drive experience more direct, which can make the unit feel aggressive.

System: Charger Menu

Parameter	Range	Description
Charger Inhibit	Low active / High active	Defines whether the system 'Charger Inhibit' signal set by the charger connector is 'Low Active' (charger pulls the inhibit signal low) or 'High Active' (charger pulls the inhibit signal high). With the correct setting, the system shows the drive inhibit state in the display top bar while the charger is connected.
Charging Detection	Disabled / Enabled	If 'Enabled' the system measures if the connected charger does charge the chair. If no charge is detected after 30 seconds, the system will issue an error message if the battery voltage is below 25V. It is possible with certain chargers that the system issues an error message even if the charger is charging. In this case, it is recommended to 'Disable' the 'Charging Detection'.

Display Parameters

The following sections describe the Display parameters.

- Display: Language Menu
- Display: Units Menu
- Display: Icon Visibility Menu
- Display: Battery Life Indication Menu
- Display: Brightness Menu
- Display: ESM Menu

Display: Language Menu

Parameter	Range	Description
Language		Sets the preferred system dialog language.

Display: Units Menu

Parameter	Range	Description
Measurement System	Miles / Km	Defines Metric or US / Imperial units for display on the system. Setting 'EU' is for metric values, 'US' for US / Imperial values.
Time Format	12h / 24h	Defines the time format for the system. Setting '12h' displays '11:25 am' and '11:25 pm'. Setting '24h' displays '11:25' and '23:25'.

Display: Icon Visibility Menu

Parameter	Range	Description
Time Indicator	Disabled / Enabled	The visibility of the Time Indicator (clock time) on the display top bar is 'Disabled' or 'Enabled' by this parameter.
Distance Indicator	Disabled / Enabled	The visibility of the Mileage Indicator on the Drive screens is 'Enabled' or 'Disabled' by this parameter.
Trip / Odo Meter		If 'Mileage Indicator' is 'Enabled', the user has the ability to choose between 'Trip Meter' or 'Odometer' in the 'Settings' menu.
Battery Percentage	Disabled / Enabled	The visibility of the Battery Percentage on the display top bar is 'Disabled' or 'Enabled' by this parameter.
Speed Indicator	Disabled / Enabled	The visibility of the Speed Indicator on the Drive screens is 'Disabled' or 'Enabled' by this parameter.
Speed Dial Type	Profile Speed / Speed Pot	This parameter configures the display indication type of the user adjustable speed range (user drive profiles minimum / maximum). The operable adjustment steps apply to all profile minimum / maximum settings. If set to 'Profile Speed', the visual indication represents the full programmable user drive profile speed range from 5–100%. Each step size for Speed Up / Speed Down is 5%. If set to 'Speed Pot', the visual indication represents the range of the programmed minimum / maximum speed settings of each profile. Each step size for Speed Up / Speed Down is 10% of the range between the profile minimum / maximum settings.

Display: Battery Life Indication Menu

Parameter	Range	Description
Battery Life Indication	Disabled / Enabled	If 'Enabled', the system will display a popup with the remaining battery charge when the battery charge is at 50%, 30% and 15%.

Display: Brightness Menu

Parameter	Range	Description
Brightness Day	5 – 100 %	Defines display brightness when ambient light conditions are above the threshold set with parameter 'Day / Night Threshold'.
Brightness Night	5 – 100 %	Defines display brightness when ambient light conditions are below the threshold set with parameter 'Day / Night Threshold'.
Day / Night	On / Off	Defines with 'On, Off' setting if the display brightness is automatically adjusted to the 'Brightness Day' and 'Brightness Night' levels according to the ambient light conditions.

Parameter	Range	Description
Day / Night Threshold	0 – 100%	Defines the ambient light threshold value to switch the display brightness between the 'Brightness Day' and 'Brightness Night' settings.
Dimming Delay	0 – 240 s	If there is no user input command for longer than the 'Dimming Delay' setting, the display brightness is reduced.

Display: ESM Menu

Parameter	Range	Description
Display and LED brightness day	5 – 100 %	Defines the ESM device display and LED brightness when ambient light conditions are above the threshold set with parameter 'Day / Night Threshold'.
Display and LED brightness night	5 – 100 %	Defines the ESM device display and LED brightness when ambient light conditions are below the threshold set with parameter 'Day / Night Threshold'.

Audio Parameters

The following sections describe the Audio parameters.

- Audio: Horn Menu
- Audio: Beep Menu
- Audio: Navigation Menu

Audio: Horn Menu

Parameter	Range	Description
Horn Volume	10 – 100 %	Defines the horn volume. The horn volume also applies to the audible warning signal while the chair is driving in reverse.
Horn Frequency	500 – 3000 Hz	Defines the Horn signal frequency. Can be adjusted to meet local traffic laws and / or user preference.

Audio: Beep Menu

Parameter	Range	Description
Beep Low Frequency	600 – 4500Hz	Defines the frequency of the low beep. Low beeps are used to indicate command beeps, navigation beeps, reminder beeps, warning and error beeps, and other system beeps.

Parameter	Range	Description
Beep Medium Frequency	600 – 4500Hz	Defines the frequency of the medium beep. Medium beeps are used to indicate navigation beeps.
Beep High Frequency	600 – 4500Hz	Defines the frequency of the high beep. High beeps are used to indicate navigation beeps.
Beep Volume	10 – 100 %	Defines the standard beep volume used for all beep types. ('Horn Volume' is a separate parameter.)
Mouse Command Beep	Off / On	If set to 'On', mouse commands give an audible feedback.
De-bounce Feedback	Off / On	If 'Enabled', an acoustical signal will be given after 'Toggle De-bounce Time' has passed.
Seat Latch Timeout Beep	Off / On	If set to 'On', latched seat functions give an audible feedback when stopped.
Memory Position 1 Beep	Disabled / Enabled	If set to 'Enabled', memory position 1 gives an audible feedback when the final memory position is reached.
Memory Position 2 Beep	Disabled / Enabled	If set to 'Enabled', memory position 2 gives an audible feedback when the final memory position is reached.
Memory Position 3 Beep	Disabled / Enabled	If set to 'Enabled', memory position 3 gives an audible feedback when the final memory position is reached.
Memory Position 4 Beep	Disabled / Enabled	If set to 'Enabled', memory position 4 gives an audible feedback when the final memory position is reached.
Memory Position 5 Beep	Disabled / Enabled	If set to 'Enabled', memory position 5 gives an audible feedback when the final memory position is reached.
Memory Position 6 Beep	Disabled / Enabled	If set to 'Enabled', memory position 6 gives an audible feedback when the final memory position is reached.
Memory Position 7 Beep	Disabled / Enabled	If set to 'Enabled', memory position 7 gives an audible feedback when the final memory position is reached.
Memory Position 8 Beep	Disabled / Enabled	If set to 'Enabled', memory position 8 gives an audible feedback when the final memory position is reached.
Sip & Puff Beep		If set to 'On', every pressure level gives an individual audio feedback as long as a valid pressure is applied to the input device.
Reverse Alarm D1	Off / On	If set to 'On', the drive profile 1, 2, 3, and/or 4 gives an intermittent audible warning while the chair is driving backwards. Sound frequency and volume settings are shared with 'Horn' parameter settings.
Reverse Alarm D2	Off / On	
Reverse Alarm D3	Off / On	
Reverse Alarm D4	Off / On	

Parameter	Range	Description
1-Switch Beep D1	Off / On	If set to 'On', in 1-Switch drive profile 1, 2, 3 and/or 4, each cursor position on the screen items gives individual beep frequencies while scanning through.
1-Switch Beep D2	Off / On	
1-Switch Beep D3	Off / On	
1-Switch Beep D4	Off / On	

Audio: Navigation Menu

Parameter	Range	Description
Navigation Beep Type		This parameter offers the following settings: • 'Disabled': No command or navigation beep is audible. • 'Basic': Transitions between profile screens, drive profiles and seat functions are audible. • 'Advanced': In addition to 'Basic', menu and list navigation is audible. • 'Command': Audible feedback if a valid input command (keys, mode switch, menu navigation with any input device, etc.) is entered.
Home / Standby Beep	Off / On	If set to 'On', the selected 'Navigation Beep Type' is audible in these screens. If set to 'Off', all beeps are deactivated for these screens.
Drive Beep	Off / On	
Aux / Settings Beep	Off / On	
Seat Beep	Off / On	

Battery Parameters

MANDATORY:

The battery settings must be set according to the battery manufacturer's specifications to ensure an accurate battery indication level is displayed.

The following sections describe the Battery parameters.

- Battery: Voltage Parameters
- Battery: Charge / Discharge Parameters

Battery: Voltage Parameters

Parameter	Range	Description
Reset Voltage	2.15 – 2.25 V	If the battery voltage meets or exceeds this voltage level at system power up, then the system assumes that the battery has been fully charged and resets the battery capacity and indicator to 100% (fully charged).
Full Voltage (Charge)	2.20 – 2.40 V	Defines the Battery voltage per cell at 100% battery charge (fully charged) **while charging**. This parameter is not only dependent on the battery but also on the charger (charge rate, profile, etc.).
Empty Voltage (Charge)	1.80 – 2.20 V	Defines the Battery voltage per cell at 0% battery charge (empty battery) **while charging**. This parameter is not only dependent on the battery but also on the charger (charge rate, profile, etc.).
Full Voltage (Discharge)	2.00 – 2.10 V	Defines the voltage per cell of the battery at 100% (fully charged) of the usable battery capacity during a discharge process (system stand by, driving). These parameters are mainly dependent on the battery type (Lead Acid, Ni-Cd, etc.), technology (wet, gel, etc.) and manufacturer.
Empty Voltage (Discharge)	1.50 – 2.00 V	Defines the voltage per cell of the battery at 0% (empty battery) of the usable battery capacity during a discharge process (system stand by, driving). These parameters are mainly dependent on the battery type (Lead Acid, Ni-Cd, etc.), technology (wet, gel, etc.) and manufacturer. **WARNING:** A too low voltage value (below battery specification) may lead to deep discharge causing damage to the battery.

Battery: Charge / Discharge Parameters

Parameter	Range	Description
Charge Rate	1 – 10	This parameter is used to adjust the system Battery Indicator accuracy while charging. It depends on the battery capacity, battery age, and charging rate. An average value setting is '5'. It should be set higher than '5' for high capacity batteries or low current charging (long charging time). It should be set lower than '5' for low capacity batteries or high current charging (short charging time). A change of 1 unit increases / decreases the rate by 20%.

Parameter	Range	Description
Discharge Rate	1 – 10	This parameter is used to adjust the system Battery Indicator accuracy while discharging. It depends on the battery capacity, battery age, and discharge pattern. An average value setting is '5'. It should be set higher than '5' for high capacity batteries or low current discharging (long discharging time). It should be set lower than '5' for low capacity batteries or high current discharging (short discharging time). A change of 1 unit increases / decreases the rate by 20%.

Light Parameters

The following sections describe the Light parameters.

- Light: Light Settings Parameters
- Light: LED Light Settings Parameters

Light: Light Settings Parameters

Parameter	Range	Description
Light Voltage	6 – 24 V	Defines the standard nominal operation voltage for the front, back and indicator lights. Make sure this setting meets the light product specification.
Indicator Fault Current	0.0 – 2.0 A	If the current of an indicator (left or right) is below this limit, then the indicator frequency of the affected indicator will be doubled. If indicator detection is missing, the indicator frequency will be doubled and a warning message will be issued.
Indicator Timeout	5 – 300 s	Defines the time, in seconds, after which the indicators automatically turn off. **Important:** This timeout does not end the hazard indication mode.
Blink Frequency	0.5 – 2.0 Hz	Defines the blink frequency for indicators and hazard lights.

Light: LED Light Settings Parameters

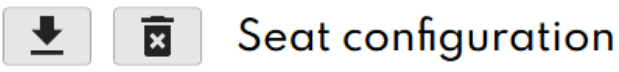
Parameter	Range	Description
Light Voltage LED	6 – 12V	Defines the standard nominal operation voltage for the front, back and indicator lights. Make sure this setting meets the light product specification.

Parameter	Range	Description
Indicator Timeout	5 – 300 s	Defines the time, in seconds, after which the indicators automatically turn off. **Important:** This timeout does not end the hazard indication mode.
Blink Frequency	0.5 – 2.0 Hz	Defines the blink frequency for indicators and hazard lights.
Front Light Fault Current	0 – 370mA	If the current of the front light is below this limit, a warning message will be issued.
Rear Light Fault Current	0 – 120mA	If the current of the rear light is below this limit, a warning message will be issued.
Indicator Fault current	0 – 480mA	If the current of an indicator (left or right) is below this limit, then the indicator frequency of the affected indicator will be doubled and a warning message will be issued.
Front Light Overcurrent	185 – 1000mA	If the current of the front light is above this limit, the light function will automatically be turned off and a warning message will be issued.
Rear Light Overcurrent	60 – 1000mA	If the current of the rear light is above this limit, the light function will automatically be turned off and a warning message will be issued.
Indicator Overcurrent	240 – 1000mA	If the current of an indicator (left or right) is above this limit, then the indicator function will automatically be turned off and a warning message will be issued.

Seat Configuration

The seat configuration can be customized from any programming device. However, for full programming capabilities, ECON must be used.

The entire seat configuration is one individual unit that contains multiple parameters. Changes to the seat configuration have to be saved in order to make them operative.



The following sections describe how to configure seat configuration.

- Seat Configuration: Drive Speed Restrictions
- Seat Configuration: Actuator Movement Restrictions
- Seat Configuration: Functions
- Seat Configuration: Combined Functions
- Screen Configuration: Functions Order

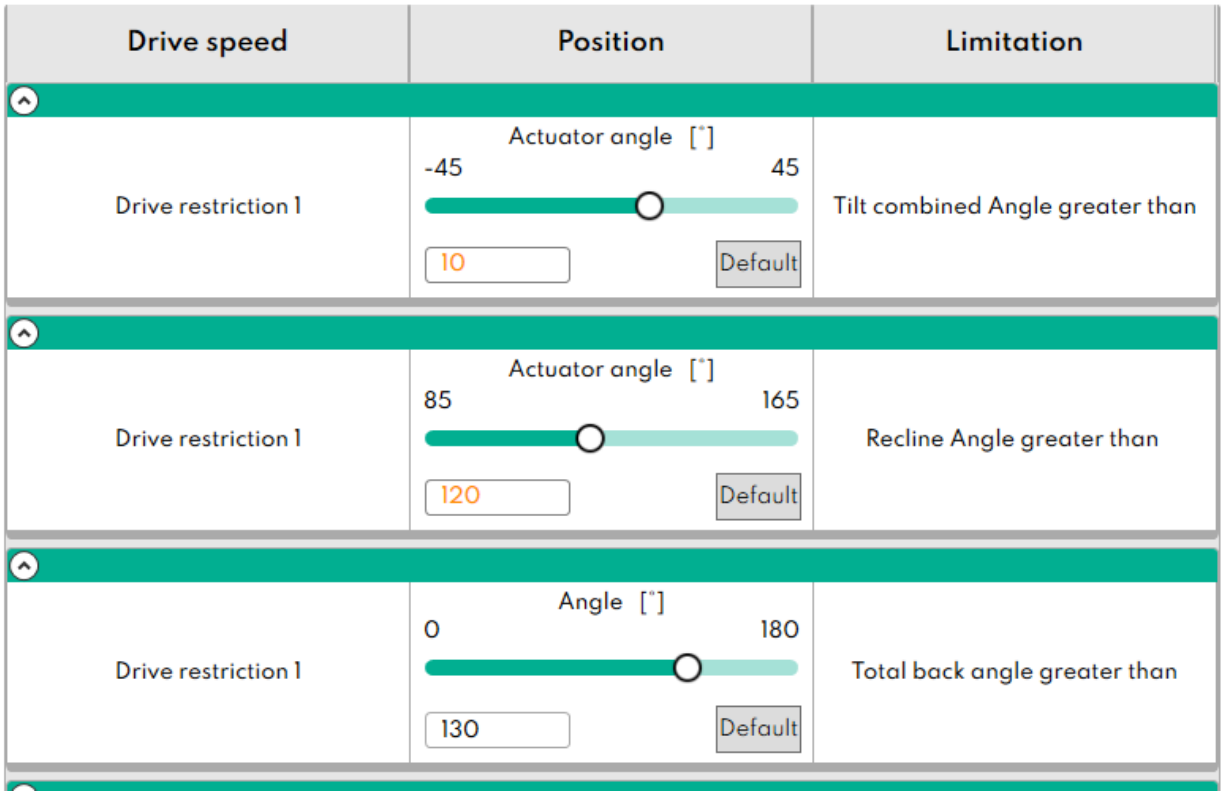
- Seat Configuration: Actuators
- Seat Configuration: Restrictions
- Seat Configuration: Fallback Restrictions
- Seat Configuration: Fallback Inclination
- Seat Configuration: Mapping

Related information

Seat Parameters

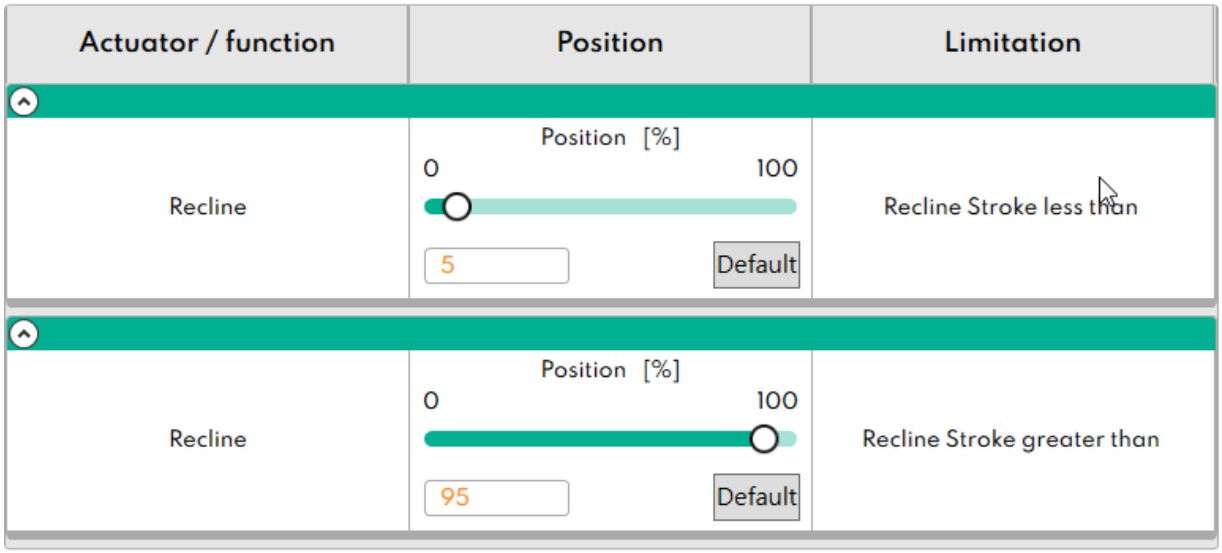
Seat Configuration: Drive Speed Restrictions

The following image shows a simplified dealer view of Drive Speed restrictions. This view allows the Dealer to change inclination values, actuator stroke values, and actuator angle values, if applicable.



Seat Configuration: Actuator Movement Restrictions

The following image shows a simplified dealer view of Actuator Movement restrictions. This view allows the Dealer to change inclination values, actuator stroke values, and actuator angle values, if applicable.

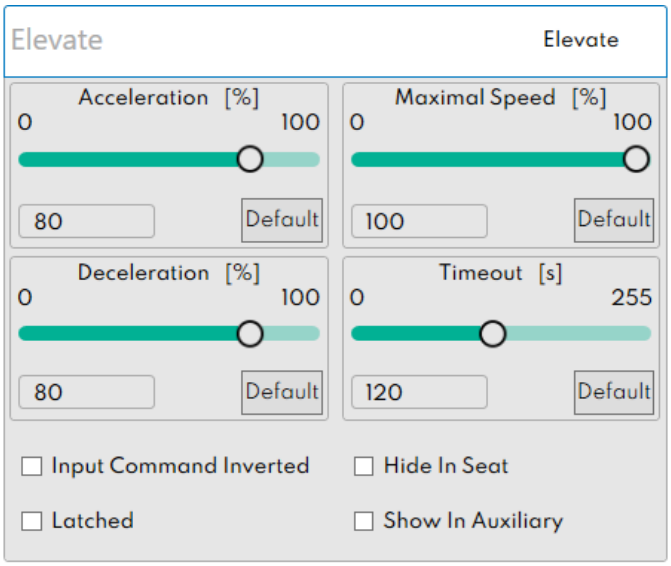


Seat Configuration: Functions

Functions define the speed, acceleration, deceleration, and timeout of the configured actuators. The following table describes the parameters that configure functions.

Parameter	Range	Description
Acceleration	0 – 100 %	Defines the acceleration of the actuator. A higher value represents a shorter acceleration time to maximum speed.
Deceleration	0 – 100 %	Defines the deceleration of the actuator. A higher value represents a shorter deceleration time from maximum speed.
Maximal Speed	0 – 100 %	Defines the maximum speed of the actuator.
Timeout	0 – 255 s	Amount of time the function will run continuously before stopping.
Input Command Inverted		Swaps the seat function direction for forward / reverse input.
Hide In Seat		Hides the function in the Seat Profile.
Show In Auxiliary		Shows the function in the Auxiliary Menu.
Latched		Latches the seat function when an input command is given.

Figure 63. ECON Seat Functions Screen



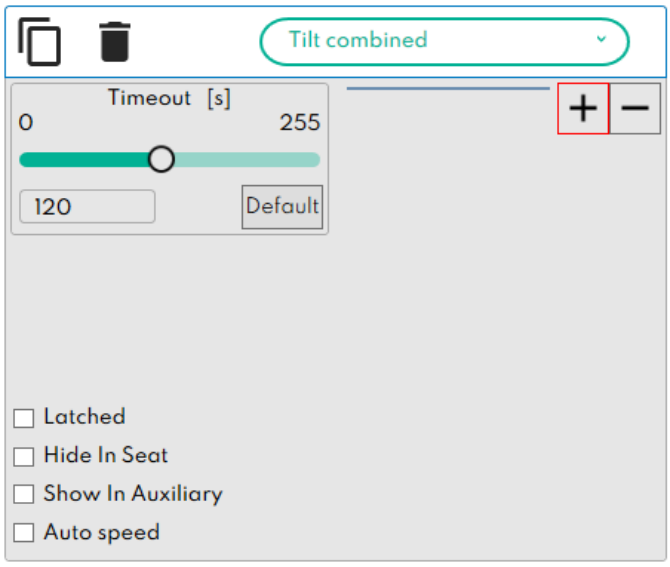
Seat Configuration: Combined Functions

Combined Functions configure two or more functions to work simultaneously. The drop down menu defines the text of the Combined Function. The "+" and "–" controls add and delete functions. Multiple combined functions can be added.

The following table describes the parameters that configure combined functions.

Parameter	Range	Description
Timeout	0 – 255 s	Amount of time the combined function will run continuously before stopping.
Maximal Speed	0 – 100 %	Defines the maximum speed for a function within a combined function.
Latched		Latches the combined function when an input command is given.
Hide In Seat		Hides the combined function in the Seat Profile.
Show In Auxiliary		Shows the combined function in the Auxiliary menu.
Auto Speed		All actuators in the combined function run at the same speed independent of the individual speed setting.
Change Direction		Changes the direction of a function within a combined function.

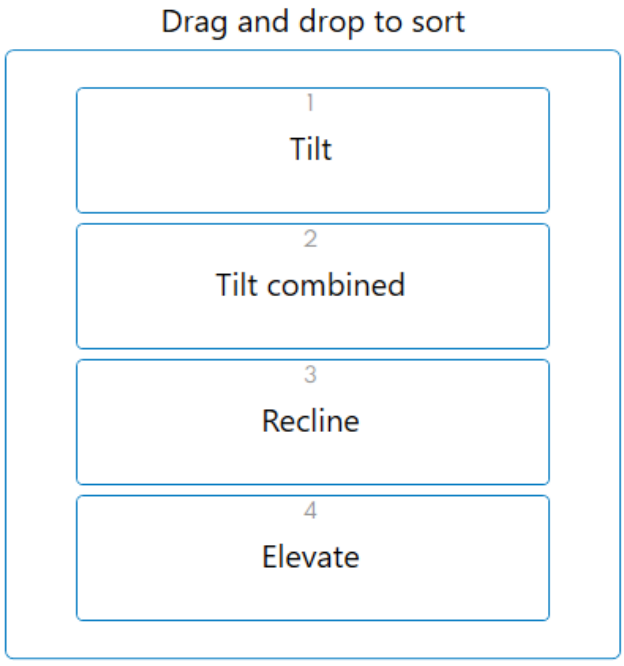
Figure 64. ECON Combined Functions Screen



Screen Configuration: Functions Order

Functions Order defines the order of all configured functions and combined functions when cycling through the seat profile. To change the order, drag and drop the functions.

Figure 65. ECON Functions Order Screen



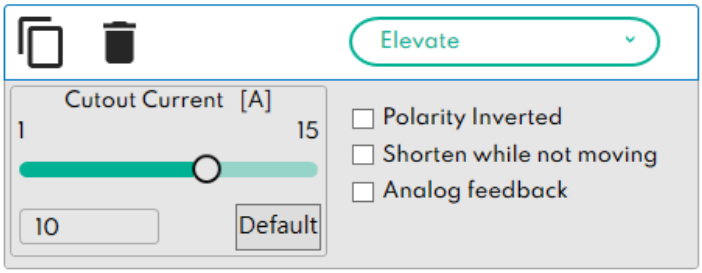
Seat Configuration: Actuators

The Actuators parameters allow customization of an actuator, including adding a new or deleting an existing actuator. Each actuator can be assigned to any port on the connected actuator module.

The following table describes the parameters that configure actuators.

Parameter	Range	Description
Polarity Inverted		Changes the polarity of the actuator port output.
Shorten while not moving		Disables the output port internally to help prevent actuator back drive.
Analog Feedback		Configures the Actuator to provide feedback for Smart Seating.
Cutout Current	1 – 15 A	Assigned actuator output turns off if this current is met.

Figure 66. ECON Actuators Screen



Seat Configuration: Restrictions

The following table describes the types of restrictions:

Restriction Type	Description
Actuator Restriction	Prevents the actuator from moving as defined by the **restriction** when the programmed feedback conditions are met.
Seat Restriction	Prevents the seat function from moving as defined by the **restriction** when the programmed feedback conditions are met. This includes combined functions.
Drive Restriction	Reduces or prevents drive when the programmed feedback conditions are met.
Memory Seating Restriction	Prevents the memory seat function from moving as defined by the **restriction** when the programmed feedback conditions are met.

The following table describes the Restrictions parameters:

Parameter	Range	Description
Restriction Type		Available for Actuator and Seat Restriction: • Forward Restriction - Prevents specific forward actuator/seat movement if the configured condition(s) is/are met. • Reverse Restriction - Prevents specific reverse actuator/seat movement if the configured condition(s) is/are met. • Stop Restriction - Prevents specific actuator/seat movement if the configured condition(s) is/are met.
Chair Drive Limit		Available for Drive Restriction. Choose one of Drive Restrictions 1 to 6 as configured in the Drive Speed Restrictions section.
Memory seating restriction type		Defines the action to be taken when the restriction applies: • Disabled – Applies restriction. • Enabled – Ignores restriction.
Memory Position		Defines which memory position is restricted when the Memory Seating Restriction type is disabled.
Actuator Type		This parameter is available for an Actuator or Seat Restriction. The parameter restricts the chosen function as defined by the condition.
ESM Indication		This parameter is available for a Drive Restriction. The parameter changes the LED indication color on the ESM's corresponding actuator function if the Drive Restriction is met.
Display Indication		Selects text indicating drive restriction based upon the display indication selection. Selections are: • None • Tilt and elevate • Recline • Elevate • Multiple
Switch Condition		**Switch Type**: • Switch Closed – The condition is met when the configured switch is closed. • Switch Open – The condition is met when the configured switch is open.
Inclination Condition		Defines the angle of inclination where the condition is met (can be defined for "Total Back Angle Less Than" or "Total Back Angle Greater Than.")

Parameter	Range	Description
Actuator Stroke Condition		Defines the actuator stroke where the condition is met (can be defined for "Stroke Less Than" or "Stroke Greater Than.")
Drive Condition		Defines the drive state where the condition is met (can be defined for "not driving" or "driving").
Chair Base Vibration		Defines the condition that is triggered by chair base vibration (%).
Actuator Angle Condition		Defines the actuator angle where the condition is met (can be defined for "Angle Less Than" or "Angle Greater Than").
Show in Restrictions		Shows specific restrictions in the Dealer view (Actuator movement restrictions, Drive Speed restrictions and Fallback Inclination").

Seat Configuration: Fallback Restrictions

Fallback restrictions are restrictions that apply in the event of actuator feedback errors. The following table describes the types of fallback restrictions:

Fallback Restriction Type	Description
Actuator Restriction	Prevents the actuator from moving as defined by the **restriction** when the programmed feedback conditions are met.
Seat Restriction	Prevents the seat function from moving as defined by the **restriction** when the programmed feedback conditions are met. This includes combined functions.
Drive Restriction	Reduces or prevents drive when the programmed feedback conditions are met.

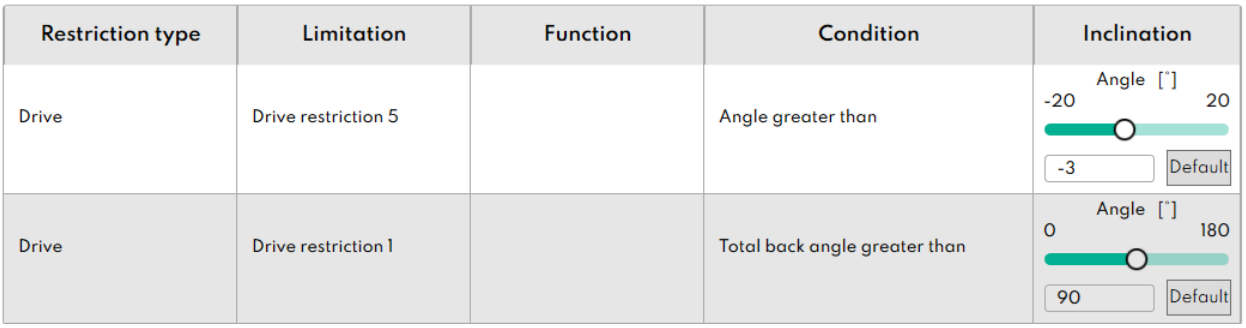
The following table describes the fallback restriction parameters:

Parameter	Range	Description
Restriction Type		Available for Actuator and Seat Restriction. • Forward Restriction - Prevents specific forward actuator/seat movement if the configured condition(s) is/are met. • Reverse Restriction - Prevents specific reverse actuator/seat movement if the configured condition(s) is/are met. • Stop Restriction - Prevents specific actuator/seat movement if the configured condition(s) is/are met.
Chair Drive Limit		Available for Drive Restriction. Choose one of Drive Restrictions 1 to 6 as configured in the Drive Speed Restrictions section.
Actuator Type		This parameter is available for an Actuator or Seat Restriction. The parameter restricts the chosen function as defined by the condition.

Parameter	Range	Description
ESM Indication		This parameter is available for a Drive Restriction. The parameter changes the LED indication color on the ESM's corresponding actuator function if the Drive Restriction is met.
Display Indication		Selects text indicating drive restriction based upon display indication selection. Selections are: • None • Tilt and elevate • Recline • Elevate • Multiple
Switch Condition		**Switch Type**: Switch Closed – The condition is met when the configured switch is closed. Switch Open – The condition is met when the configured switch is open.
Inclination Condition		Defines the angle of inclination where the condition is met (can be defined for "Total Back Angle Less Than" or "Total Back Angle Greater Than.")
Drive Condition		Defines the drive state where the condition is met (can be defined for "not driving" or "driving").
Chair Base Vibration		Defines the condition that is triggered by chair base vibration (%).

Seat Configuration: Fallback Inclination

The following image shows a simplified dealer view of Fallback Inclination restrictions. This view allows the Dealer to change inclination values, if applicable.



Seat Configuration: Mapping

The Mapping parameters configure how the system works with Actuator Module orientation. The parameters define the Actuator Module type, Actuator Module output, End Switches, and mounting options. These settings are important for ensuring correct functionality of the inclination sensor.

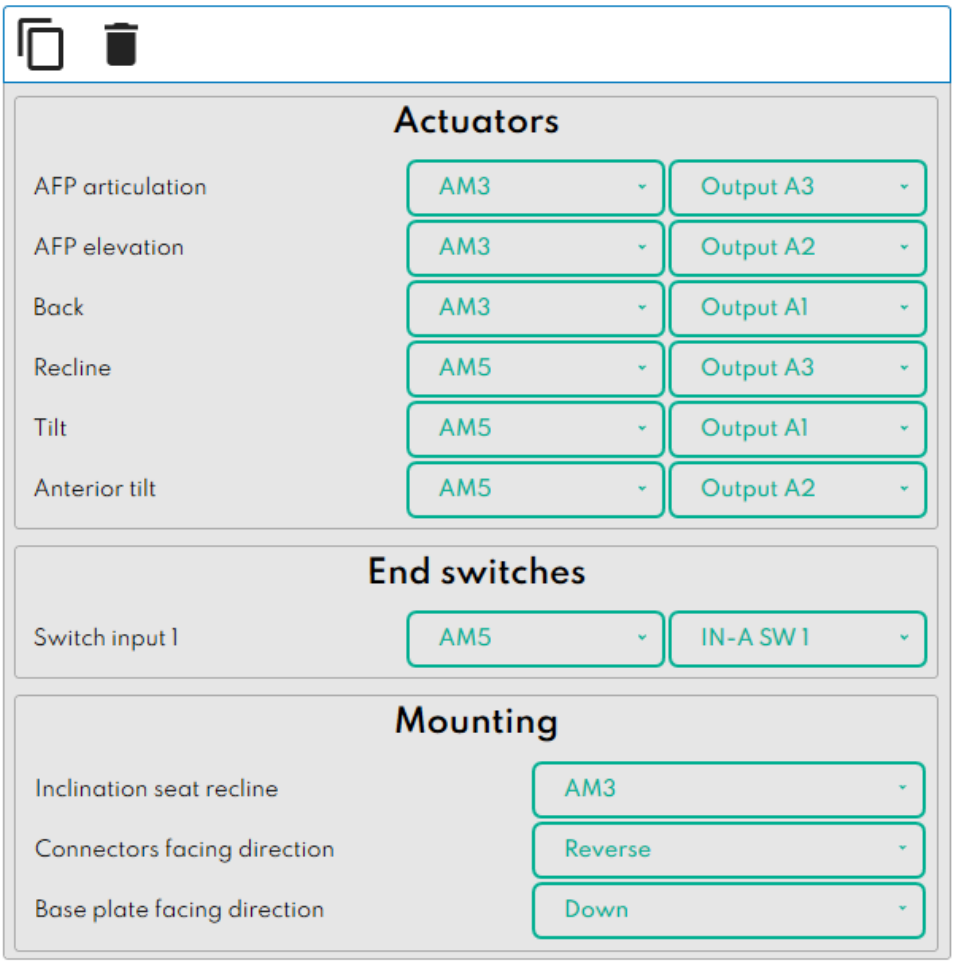
MANDATORY:

This setting is critical to ensure that the Inclination Sensor Tilt Angle is positive when the seat is tilted or reclined backward, and negative when the seat is tilted or reclined forward. The inclination angle is used for seat, actuator, drive restrictions, and the **total back angle head control**.

The following table describes the mapping parameters.

Parameter	Range	Description
Actuator Module		Defines the Actuator Module used for the particular Actuator required.
Actuator Module Output		Defines the output to be used on the Actuator Module for the Actuator required.
End Switch Actuator Module		Defines the Actuator Module used for the particular End Switch required.
End Switch Output		Defines the Output to be used on the Actuator Module for the End Switch required.
Inclination Seat Recline Mounting		Defines the Actuator Module used for the Inclination seat recline.
Connectors Facing Direction		Defines the direction that the Actuator Module connectors face when mounted. (View from behind the chair.)
Base Plate facing direction		Defines the direction that the Actuator Module base plate faces when mounted. (View from behind the chair.)

Figure 67. ECON Mapping Screen



Mapped I/O Support

Inputs and outputs can be configured for the system via the following I/Os:

- ESM Configuration
- Mode Jack (HC, DM) and switch inputs (PB120, AAM5). See Mapped I/O.

ESM Configuration

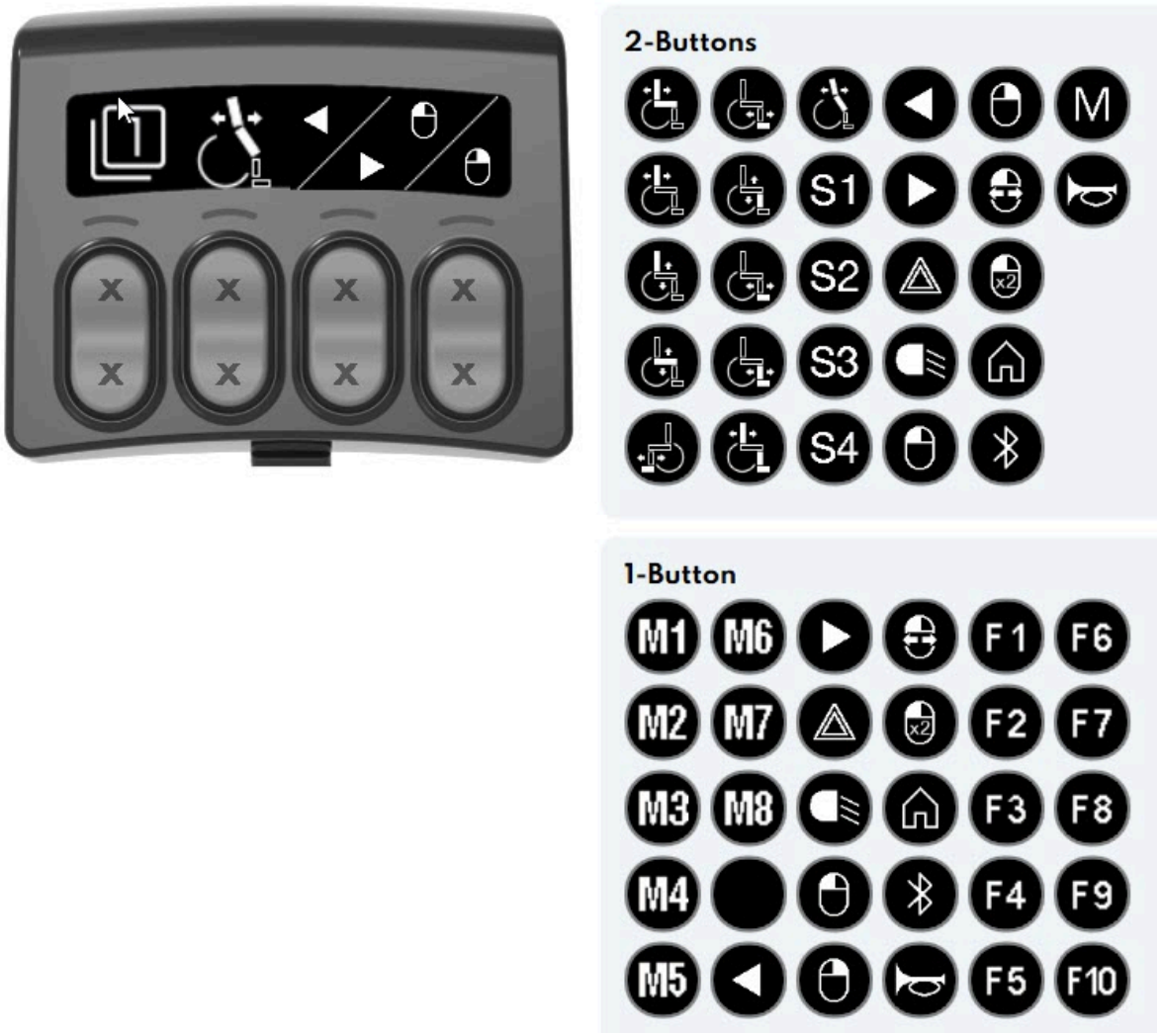
The Enhanced Switch Module configurator uses drag and drop functionality to place the chosen icons for system functions onto the desired switch. The icons use one or two switches.

There are three different modes for the ESM:

Mode	Description
Single Page	Only one page of the ESM is used.

Mode	Description
Multi Page Left	Up to five pages can be configured, and the leftmost switch scrolls through the pages.
Multi Page Right	Up to five pages can be configured, and the rightmost switch scrolls through the pages.

Figure 68. ESM Configuration in ECON



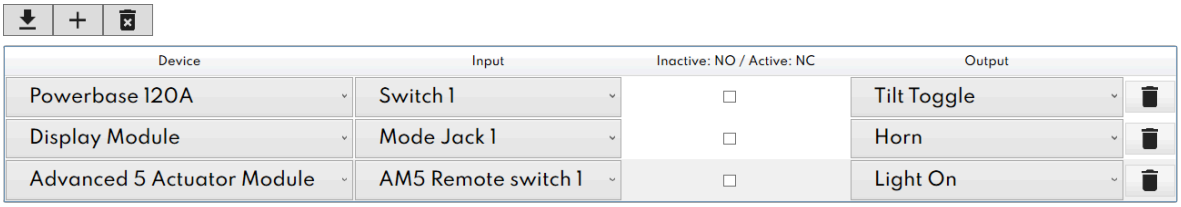
When the ESM is configured, click the **Save** icon to download the changes to an online system. To save the changes to an offline configuration, use **File > Save or File > Save As**.

Mapped I/O

The Mapped I/O assignment uses dropdown menus to select the device, input, and output. Each assignment can be normally open (NO) or normally closed (NC). There are over 80 different output options.

When all Mapped I/O is configured, click the **Save** icon to download the changes to an online system. To save the changes to an offline configuration, use **File > Save or File > Save As**.

Figure 69. Mapped I/O Configuration in ECON



6 — Diagnostics and Troubleshooting

The ECON programming devices provide access to real-time data when connected to an online enAble X1 system. The diagnostic tools described in the following sections can help troubleshoot issues to find a quick resolution.

The following sections describe diagnostics and troubleshooting:

- Device List
- Error Information
- Monitor
- Battery Statistics
- Remote Display
- Access and Change Log
- Severity Levels
- Fault Code List

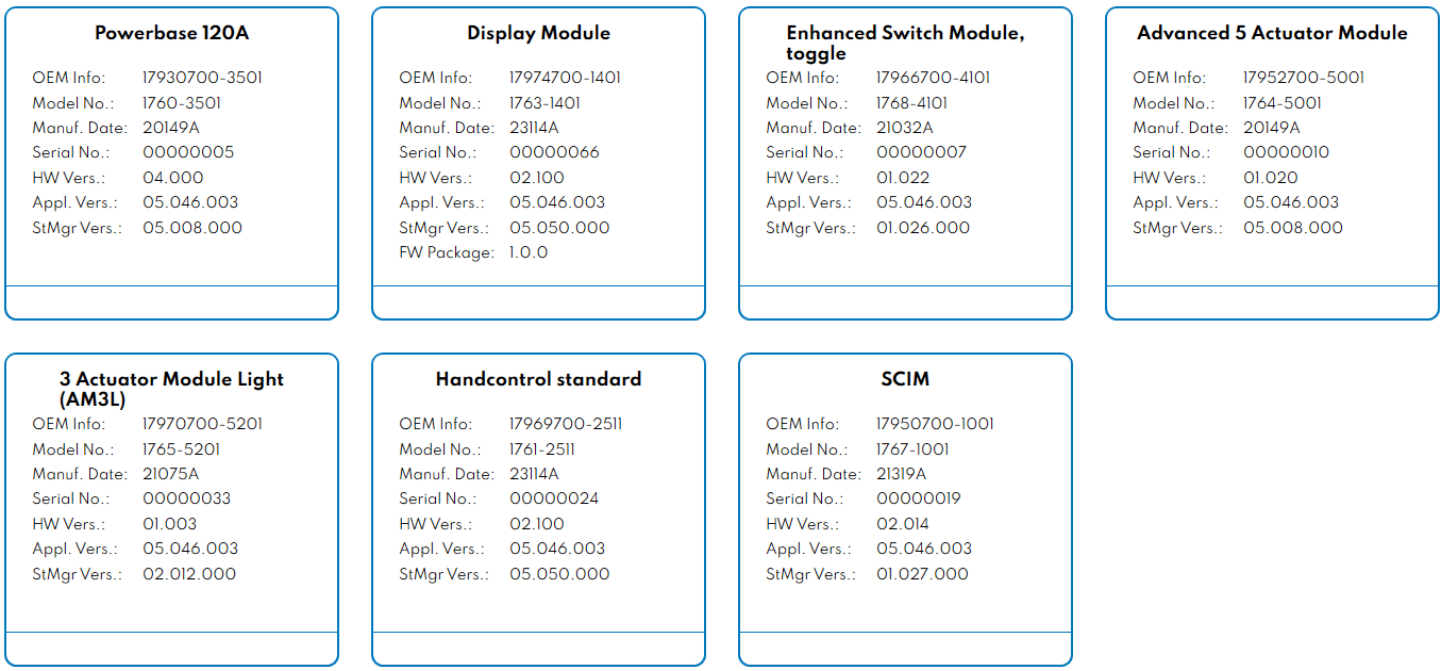
Note:

All screenshots in these sections are from ECON-W.

Device List

The device list shows all enAble X1 modules on the connected system.

Figure 70. ECON Device List Screen



Each module includes the following information:

Information	Description
OEM Info	Part number defined by the OEM.
Model	Curtis Instruments, Inc. model number.
Man. Date	Date and location of manufacture.
Serial No.	Module serial number.
HW Ver.	Module hardware version.
SW Ver.	Module software version.
StMgr	Module start manager version.

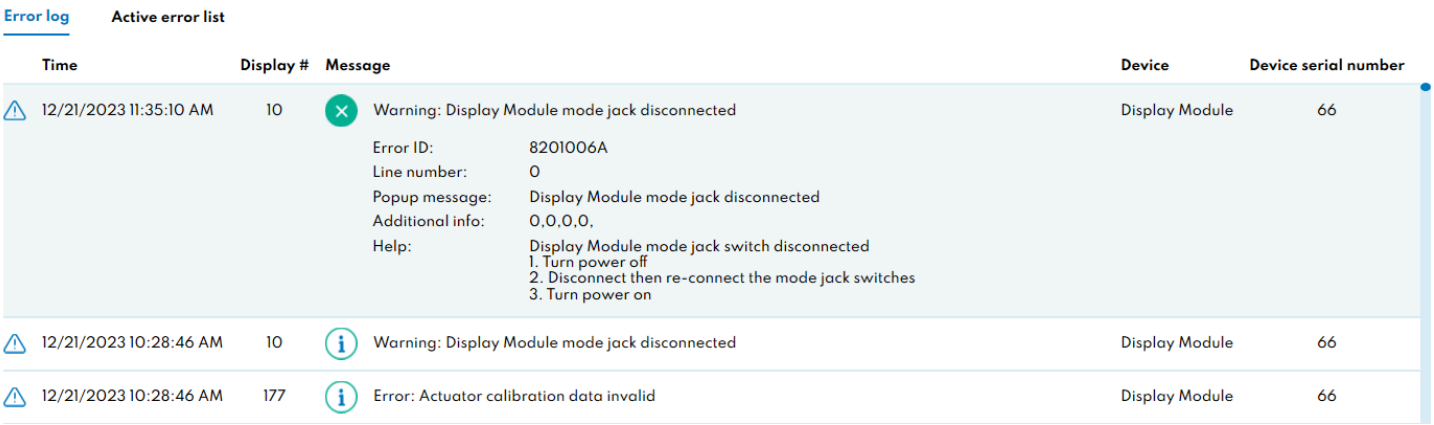
The device list is saved and viewable in an offline configuration.

Error Information

The error information shows the active error list and a history of the error log. Each error is timestamped, and shows which module the error originated from. Each error entry can be expanded to show additional information, including help text to further diagnose an issue. The error information can be deleted by using the DELETE ERROR HISTORY function when connected to an online system.

The error log is saved and viewable in an offline configuration.

Figure 71. ECON Error Information Screen

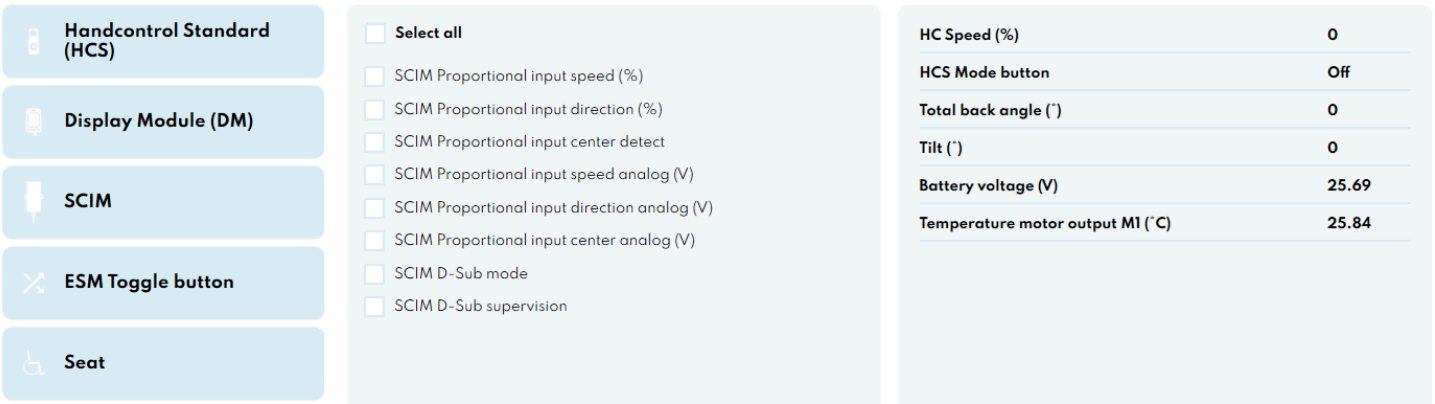


Monitor

The Monitor menu shows the status of module inputs and outputs, and various system statistics such as driven distance reminders, hour meters, battery voltage, etc. The menu structure is easy to navigate. The I/O and system statistics are organized under the module to which it belongs. Once the desired signals are selected, the live values are displayed. A logging feature is available to record and save a trace of the currently selected monitor values.

Monitor values are saved and viewable in an offline configuration as a snapshot from when the configuration was saved.

Figure 72. ECON Monitor Screen



Battery Statistics

The Battery Statistics screen shows historical information logged by the system. The information indicates charging habits, lowest and highest recorded battery voltage, and undervoltage and charging statistics.

The chart logs start and end battery charging, and a cell is incremented each time a charger is connected and the battery charge has incremented at least 1%.

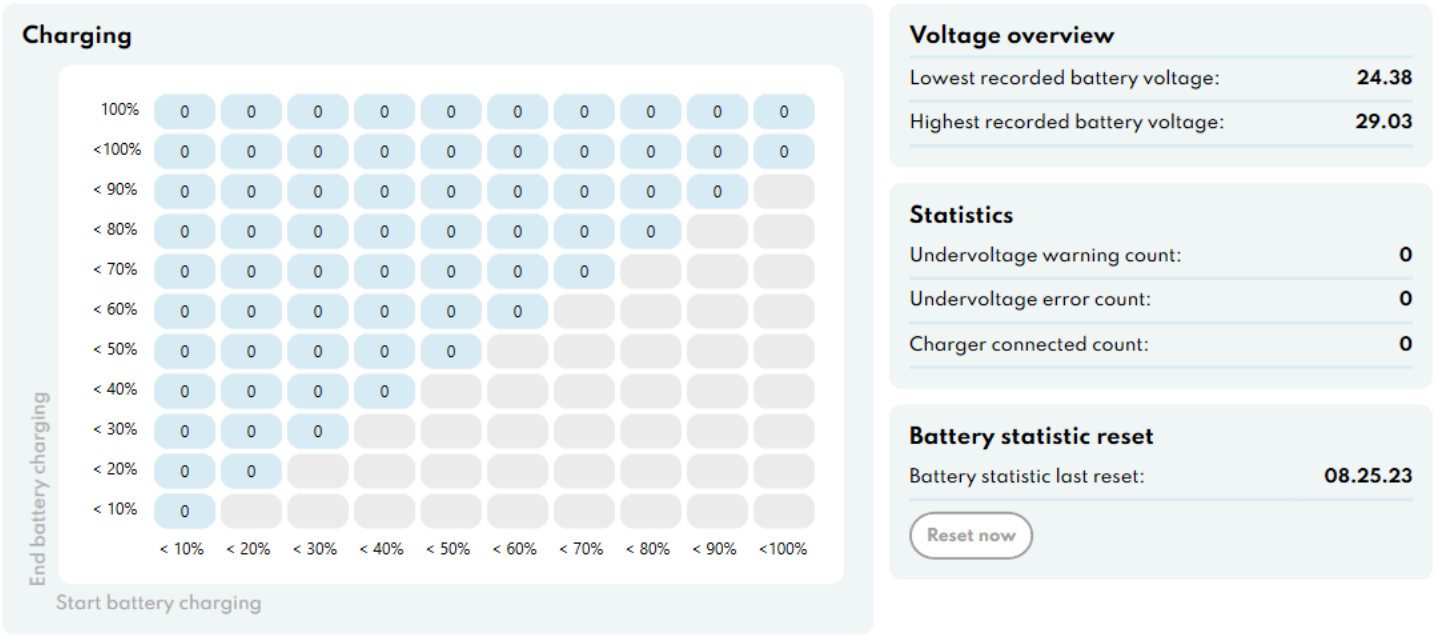
When the batteries are replaced, the Battery Statistic reset function can be used to clear all of the existing historical battery information.

Note:

Undervoltage warnings and errors do not get deleted from the Error Information log if the Battery Statistic reset function is used.

Battery Statistics are saved and viewable in an offline configuration.

Figure 73. ECON Battery Statistics Screen

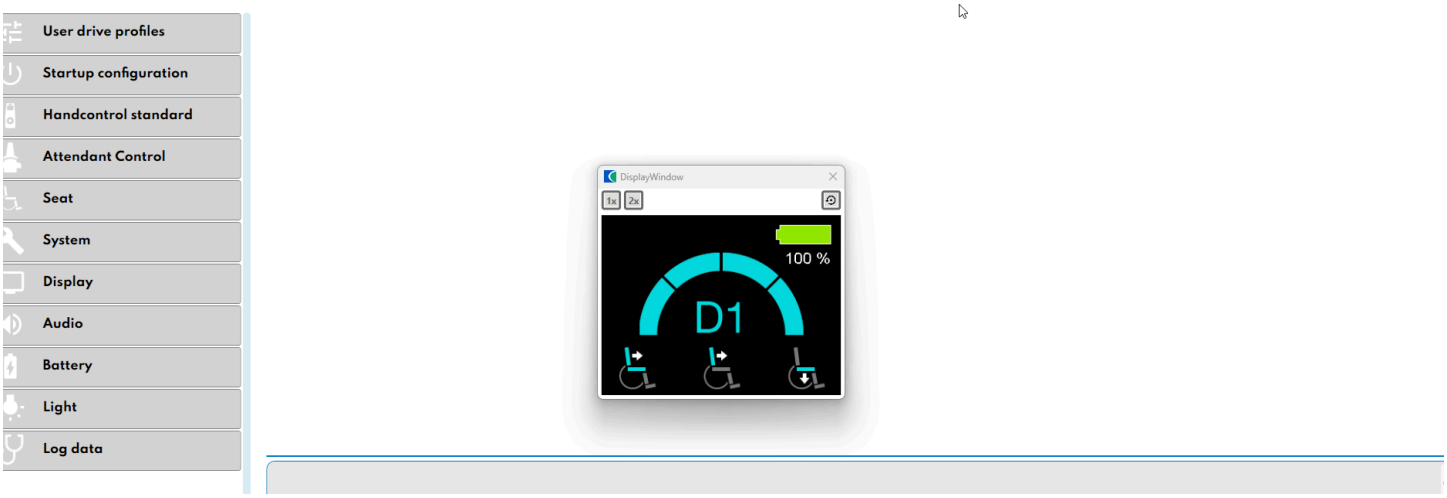


Remote Display

The Remote Display screen can be used when connected to an enAble X1 system. The screen shows a live screen mirror of what is being shown on the active display. This feature can be used with any connection type, but is implemented for a Remote Diagnostics connection. The Remote Display screen can also be used for training purposes.

See Programmer Connection Options for more information on remotely connecting to an enAble X1 system.

Figure 74. ECON Remote Display Screen

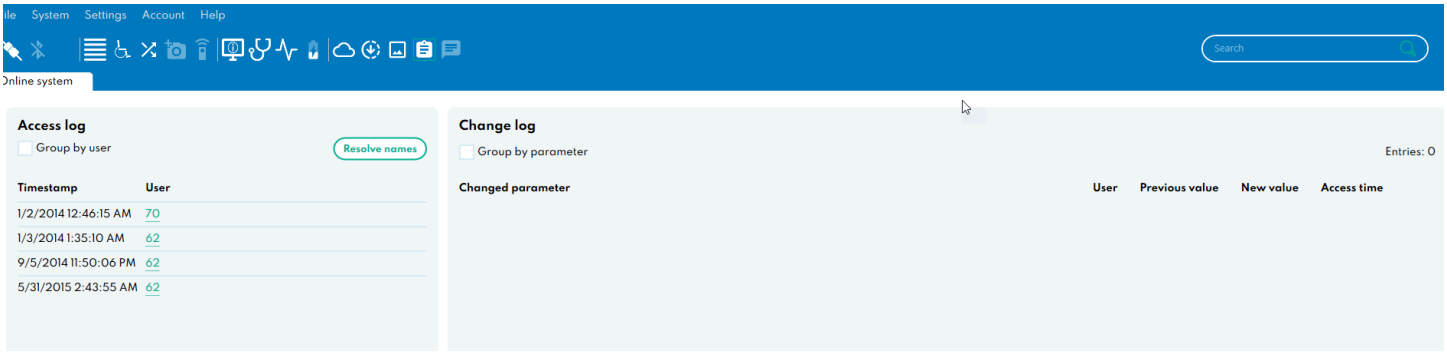


Access and Change Log

The Access and Change Log records all parameter changes made to the system, as well as the users who made the changes. It also logs the previous and new values, and when the system was accessed to make these changes. The access and change log information can be deleted by using the DELETE ACCESS AND CHANGE LOG function when connected to an online system.

The Access and Change Log is only viewable when connected to an online system, and is not saved in an offline configuration.

Figure 75. ECON Access Change Log Screen



Severity Levels

When fault information is displayed, the screen of the Hand Control Standard or Display Module displays the fault's severity level above the fault code. Most faults have a Warning or Error severity level.

The following table describes the severity levels and the images that indicate them.

Table 28. Fault Severity Levels

Severity Level	Description	Hand Control Standard	Display Module
Warning	Indicates either status information or a malfunction that is not severe enough to stop the chair.		

Table 28. Fault Severity Levels (continued)

Severity Level	Description	Hand Control Standard	Display Module
Error	Indicates a malfunction that prevents the chair from being fully operational.		
Anomaly	Indicates either status information or a malfunction that is not severe enough to stop the chair.		
Information	Indicates status information that is not to the level of an error or warning. **Note:** Information messages might not display the fault number.		

Fault Code List

The enAble X1 system detects a wide variety of faults and error conditions. Fault and error information is shown by a pop-up on the system's main display (HCS or DM). When a fault or informational pop-up occurs, an audible alert will be made based on BEEP VOLUME and BEEP LOW FREQUENCY settings. The displayed fault information is logged, and is accessible by a programming device.

Some faults are not recoverable, and require replacing a system component. However, sometimes the fault circuits catch a temporary or extreme event that is not a true fault in the system. Turning the power off and back on again will help determine if the fault is permanent or repeatable.

Other faults can be remedied by correcting an operational condition. For example, in response to an Undervoltage warning, recharge the battery.

If the problem doesn't go away when power is cycled, or if the precise nature of the fault isn't clear, connect a programmer and look in the Error Information to find out more about the precise fault that is occurring. The problem may be as simple as a loose connection or faulty wiring that can be easily fixed.

Table 29. Fault List

Fault Code	Type	Description	Recovery Steps
1	Error	Motor 1 not connected	**Motor 1 error detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
2	Error	Motor 2 not connected	**Motor 2 error detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
3	Error	Brake 1 not connected	**Brake 1 error detected** 1. Turn power off 2. Disengage then re-engage brake lever 3. Inspect motor connections 4. Turn power on
4	Error	Brake 2 not connected	**Brake 2 error detected** 1. Turn power off 2. Disengage then re-engage brake lever 3. Inspect motor connections 4. Turn power on
5	Warning	Attendant Control on / off jack disconnected	**Attendant Control on / off jack switch disconnected** 1. Turn power off 2. Disconnect then re-connect the on / off jack switch 3. Turn power on
6	Warning	Display Module on / off jack disconnected	**Display Module on / off jack switch disconnected** 1. Turn power off 2. Disconnect then re-connect the on / off jack switch 3. Turn power on
7	Warning	Handcontrol on / off jack disconnected	**Handcontrol on / off jack switch disconnected** 1. Turn power off 2. Disconnect then re-connect the on / off jack switch 3. Turn power on
9	Warning	Attendant Control mode jack disconnected	**Attendant Control mode jack switch disconnected** 1. Turn power off 2. Disconnect then re-connect the mode jack switches 3. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
10	Warning	Display Module mode jack disconnected	**Display Module mode jack switch disconnected** 1. Turn power off 2. Disconnect then re-connect the mode jack switches 3. Turn power on
11	Warning	Handcontrol mode jack disconnected	**Handcontrol mode jack switch disconnected** 1. Turn power off 2. Disconnect then re-connect the mode jack switches 3. Turn power on
13	Warning	D-Sub (9-Pin) disconnected	**D-Sub (9-Pin) disconnected** 1. Turn power off 2. Disconnect then re-connect the D-Sub (9-Pin) 3. Turn power on
14	Warning	Proportional input device not connected	**Proportional input device not connected** If configured wrong: 1. Connect programming device 2. Select correct input device Otherwise: 1. Turn power off 2. Disconnect then re-connect the D-Sub (9-Pin) 3. Turn power on
14	Error	Proportional input device not connected	**Proportional input device not connected** If configured wrong: 1. Connect programming device 2. Select correct input device Otherwise: 1. Turn power off 2. Disconnect then re-connect the D-Sub (9-Pin) 3. Turn power on
15	Warning	Drive motor encoder not connected	**Encoder error detected** 1. Turn power off 2. Disconnect both encoder cables 3. Inspect encoder connections 4. Reconnect both encoder cables 5. Turn power on
16	Error	Brake 1 shorted or programmed incorrectly	**Brake 1 error detected** 1. Connect programming device 2. Check Brake Voltage Setting 3. Turn power off 4. Disengage then re-engage brake lever 5. Inspect motor connections 6. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
17	Error	Brake 2 shorted or programmed incorrectly	**Brake 2 error detected** 1. Connect programming device 2. Check Brake Voltage Setting 3. Turn power off 4. Disengage then re-engage brake lever 5. Inspect motor connections 6. Turn power on
18	Warning	Actuator shorted	**Seat error detected** 1. Turn power off 2. Disconnect and reconnect seat module cables one at a time 3. Turn power on
19	Warning	Drive motor encoder shorted	**Encoder error detected** 1. Turn power off 2. Disconnect both encoder cables 3. Inspect encoder connections 4. Reconnect both encoder cables 5. Turn power on
20	Warning	Undervoltage	Charge battery
20	Error	Undervoltage	Charge battery
21	Error	Overvoltage	Check the battery voltage, batteries may be overcharged. Avoid driving downhill fast with fully charged batteries.
22	Warning	Speed reduction (Overvoltage)	Check the battery voltage, batteries may be overcharged. Avoid driving downhill fast with fully charged batteries.
23	Error	Motor 1 output defect	**Motor 1 error detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
24	Error	Motor 2 output defect	**Motor 2 error detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
25	Error	Brake 1 error	**Brake 1 error detected** 1. Turn power off 2. Disengage then re-engage brake lever 3. Inspect motor connections 4. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
26	Error	Brake 2 error	**Brake 2 error detected** 1. Turn power off 2. Disengage then re-engage brake lever 3. Inspect motor connections 4. Turn power on
27	Error	Motor output defect	**Powerbase error detected** 1. Turn power off 2. Check Motor wiring and wait 5 seconds 3. Turn power on
28	Warning	Main contactor error	**Powerbase error detected** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
29	Warning	Main contactor error	**Powerbase error detected** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
30	Error	Main contactor error	**Powerbase error detected** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
31	Warning	Motor stall detected	**Motor stall detected** 1. Back up and try to overcome obstacle again with more speed. 2. If chair stalls again, drive around the obstacle or find a location where the obstacle height is lower.
32	Error	Overtemperature	**Chair stopped to protect system electronics** Turn power off to let system cool down. Note: This is the normal system behavior.
33	Warning	Speed reduction (Overtemperature)	**Chair speed is reduced to protect system electronics** Turn power off to let system cool down. Note: This is the normal system behavior.
34	Error	Bus voltage dropped	**Primary system module (HCS / DM) error detected** 1. Turn power off 2. Inspect Handcontrol and / or Display Module cable 3. Disconnect and reconnect Handcontrol and / or Display Module cable 4. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
35	Error	Joystick not centered	**Joystick deflected at power up** 1. Turn power off 2. Release joystick to neutral position 3. Turn power on
36	Warning	Joystick out of center	**Joystick deflected at power up** 1. Turn power off 2. Release joystick to neutral position 3. Turn power on
37	Warning	Switched input pressed	**Switched input pressed at power up** 1. Turn power off 2. Release switched input 3. Turn power on
38	Error	Switched input not released	**Switched input pressed at power up** 1. Turn power off 2. Release switched input 3. Turn power on
39	Warning	Incompatible device connected	**Incompatible device** 1. Turn power off 2. Remove incompatible device 3. Turn power on
39	Error	Incompatible device connected	**Incompatible device** 1. Turn power off 2. Remove incompatible device 3. Turn power on
40	Warning	Encoder connected but not configured	**Encoder error detected** 1. Connect programming device 2. Enable encoders 3. Cycle the power 4. If encoders are available but not used, disable encoders with a programming device and unplug both encoder cables.
41	Error	Input device is not configured	**Configuration load error, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
42	Error	Module with incompatible firmware connected. See help text in error history for more information.	**Secondary module with newer firmware connected to a system:** **Handcontrol or Display Module with older firmware level connected to a system:** - Connect a programming device and updated the firmware to the latest firmware pack.

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
43	Warning	Motor 1 current measurement out of range	**Motor 1 current measurement error detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
44	Warning	Motor 2 current measurement out of range	**Motor 2 current measurement error detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
45	Warning	Input device is not present	**Input device selected is not present** 1. Connect programming device 2. In the 'Startup Configuration' menu select an input device that is connected to the system 3. Cycle the power
46	Warning	Bluetooth not working	**Bluetooth error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
48	Error	Invalid 1-Switch scanner sequence	**Invalid 1-Switch scanner sequence** 1. Connect programming device 2. Check if scanner sequence makes sense (e.g. empty)
49	Error	DMS fault	**DMS line interruption** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
50	Warning	Device exchanged	**An existing device has been exchanged / replaced, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
51	Warning	Device added	**A new device has been added to the system, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
52	Warning	Device removed	**A device was removed from the system, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
53	Warning	Sip & Puff not in neutral position	**Sip & Puff input operated at power up** 1. Turn power off 2. Release Sip & Puff input 3. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
54	Error	Sip & Puff out of neutral position	**Sip & Puff input operated at power up** 1. Turn power off 2. Release Sip & Puff input 3. Turn power on
55	Warning	INSTALLED FIRMWARE IS FOR TESTING AND DEMO PURPOSES ONLY	**The installed software was built for test purposes only.**
56	Warning	Actuator overcurrent	**Seat error detected** 1. Turn power off 2. Disconnect and reconnect seat module cables one at a time 3. Turn power on
57	Error	Severe overtemperature	**Seat error detected** 1. Turn power off to let system cool down 2. Turn power on 3. If error persists, change actuator module
58	Error	H-Bridge defect	**Seat error detected** 1. Turn power off 2. Disconnect and reconnect seat module cables one at a time 3. Turn power on 4. If error persists, change actuator module
59	Error	ADC overrun	**Software error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
60	Error	Pressure sensor not connected	**Pressure sensor not connected**
61	Warning	Non active input activated	**Non active input activated**
62	Error	Actuator relay	**Actuator module error detected** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
63	Error	Sip parameter wrong	**Sip parameter wrong**
64	Error	Puff parameter wrong	**Puff parameter wrong**
65	Warning	Switched input not released	**Switched input pressed at power up** 1. Turn power off 2. Release switched input 3. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
68	Warning	Speed reduction (Current limit)	**Chair speed is reduced to protect the motors** The reduction resets automatically after a certain time. **Note: This is the normal system behavior.**
69	Warning	Actuator timeout	**The actuator has reached the maximum set run time and has been stopped automatically.**
72	Warning	Speed reduction (Stability control) Stop chair to clear warning.	Speed reduction (Stability control) Stop chair to clear warning.
73	Warning	Speed feedback timeout	**Software error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
74	Anomaly	Intervention ramp	**Chair did not stop in the required time and was therefore stopped through the safety routine. Deceleration parameters might be set to low for the affected drive profile.**
80	Warning	System is now in configuration mode. Do not power off until completed.	**System is now in configuration mode.** **Do not power off until completed.**
81	Error	Motor overcurrent M1	**Motor 1 overcurrent detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
82	Error	Motor overcurrent M2	**Motor 2 overcurrent detected** 1. Turn power off 2. Inspect motor connections 3. Turn power on
83	Information	Automatic update of new software in process. DO NOT TURN OFF the system.	**The software has been update automatically by the primary system module.**
84	Warning	Speed reduction (Chair type / stability control not supported)	**Combination between the selected chair type and stability control is not suported.**
85	Warning	Gyro signal offset (turnrate limit or temperature range exceeded)	**Gyro turnrate limit or temperature range has been exceeded.**
86	Fault	Power cycle required	**Power cycle required**
87	Error	Actuator overtemperature	**Seat module is hot** 1. Turn chair off to let system cool down 2. Turn power on 3. If error persists, change actuator module

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
88	Warning	Front light is not connected	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
89	Warning	Rear light is not connected	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
90	Warning	Indicator left is not connected	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
91	Warning	Indicator right is not connected	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
92	Warning	Front light has low current	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
93	Warning	Rear light has low current	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
94	Warning	Indicator left has low current	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
95	Warning	Indicator right has low current	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
96	Warning	Indicator right has overcurrent	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
97	Warning	Indicator left has overcurrent	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
98	Warning	Front light has overcurrent	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
99	Warning	Rear light has overcurrent	Check if lights or indicators are plugged in. Check if lights or indicators have visible damage.
100	Warning	The total lighting current is too high	Check the lighting type Check applied voltage Check for shortcuts
101	Error	The manufacturer ID of the powerbase does not match the main module	**Make sure the connected powerbase matches the main module.** The manufacturer ID of both, main module and powerbase, must be identical.
102	Warning	Overcurrent detected on USB charger port	**USB charger port error detected** 1. Unplug the cable from both the charger port and device and check for visible damage. 2. The USB-C charger port was turned off, to resume charging capability the system must be turned off and back on. 3. If error persist try with a different cable.

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
103	Warning	USB charger port voltage out of range	**USB charger port error detected** 1. Unplug the cable from both the charger port and device and check for visible damage. 2. The USB-C charger port was turned off, to resume charging capability the system must be turned off and back on. 3. If error persist try with a different cable.
104	Error	Excessive charging current	**The bus current limit was exceeded during charging.**
120	Error	Servo 1 home position is not set or min. / max. values not calibrated	**Servo 1 home position is not set or minimum and maximum values are not calibrated.** Please set the servo 1 home position with the corresponding parameter. And calibrate the minimum and maximum values of the servo feedback by executing the 'Sensor calibration' function.
121	Error	Servo 2 home position is not set or min. / max. values not calibrated	**Servo 2 home position is not set or minimum and maximum values are not calibrated.** Please set the servo 2 home position with the corresponding parameter. And calibrate the minimum and maximum values of the servo feedback by executing the 'Sensor calibration' function.
122	Error	Servo 1 feedback out of tolerance	**Servo 1 feedback out of tolerance.** Please recalibrate the minimum and maximum value of the servo feedback by executing the 'Sensor calibration' function. If error persist check if feedback is connected or feedback cable is damaged. Exchange the cable or the servo sensor in case of any damage.
123	Error	Servo 2 feedback out of tolerance	**Servo 2 feedback out of tolerance.** Please recalibrate the minimum and maximum value of the servo feedback by executing the 'Sensor calibration' function. If error persist check if feedback is connected or feedback cable is damaged. Exchange the cable or the servo sensor in case of any damage.
124	Error	Servo 1 is not moving	**Servo 1 is not moving.** Check if servo motor 1 is connected or the cable is damaged. Exchange the cable or the servo motor in case of any damage.

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
125	Error	Servo 2 is not moving	**Servo 2 is not moving.** Check if servo motor 2 is connected or the cable is damaged. Exchange the cable or the servo motor in case of any damage.
126	Error	Servo wheels are not following the input command	**Servo wheels are not following the input command.** Check if the servo motors are connected or any cable is damaged. Exchange the cable or the servo motor in case of any damage.
127	Error	Servo module (SM2L) is missing in the system	**Servo functionality is enabled but servo module is not part of the system.** Disable the servo functionality or add a servo module to the system.
128	Error	Servo H-Bridge defect	**Servo error detected** 1. Turn power off 2. Disconnect and reconnect servo module cables one at a time 3. Turn power on 4. If error persists, change servo module
129	Error	Servo feedback supply out of tolerance	**The servo feedback supply voltage is out of tolerance.** 1. Turn power off 2. Disconnect the servo feedback cables 3. Turn power on (servo feedback errors will be shown) 4. If error persists with disconnected feedbacks, change the servo module, otherwise see point 5. 5. Reconnect the servo feedback cables one at the time. 6. If error occurs while reconnecting the feedback cables, unplug the feedback that triggered the error. 7. Change the servo sensor or servo assembly that triggers the error.
130	Error	Servo overcurrent	**Servo error detected** 1. Turn power off 2. Disconnect and reconnect servo module cables one at a time 3. Turn power on 4. If error persists and the servo wheels are not blocked, change servo module

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
150	Error	Actuator position feedback defect	**Actuator position feedback defect** The actuator position feedback is shorted or disconnected. Check if the actuator position feedback is connected or the feedback cable is damaged. If error persists, change corresponding actuator. **Additional info:** **Actuator ID:** ID of the actuator that triggered the error. See Table 30 for actuator ID and function assignment. **Actual position:** Actual position of the actuator that triggered the error. **Absolute min / max position:** The absolute min / max position of the actuator closest to the actual position. If the actual position is below 50% the min position is indicated, otherwise the max position is indicated. **Exception counter:** Indicates how many of the same errors are active.
151	Warning	Actuator position feedback is out of tolerance	**Actuator position feedback is out of tolerance** The actuator position feedback is beyond the set warning level. Recalibrate the actuator position feedback. **Additional info:** **Actuator ID:** ID of the actuator that triggered the error. See Table 30 for actuator ID and function assignment. **Actual position:** Actual position of the actuator that triggered the error. **Absolute min / max position:** The absolute min / max position of the actuator closest to the actual position. If the actual position is below 50% the min position is indicated, otherwise the max position is indicated. **Exception counter:** Indicates how many of the same errors are active.

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
152	Error	Actuator position feedback is out of tolerance	**Actuator position feedback is out of tolerance** The actuator position feedback is beyond the set error level. Recalibrate the actuator position feedback. If error persists, change corresponding actuator. **Additional info:** **Actuator ID:** ID of the actuator that triggered the error. See Table 30 for actuator ID and function assignment. **Actual position:** Actual position of the actuator that triggered the error. **Absolute min / max position:** The absolute min / max position of the actuator closest to the actual position. If the actual position is below 50% the min position is indicated, otherwise the max position is indicated. **Exception counter:** Indicates how many of the same errors are active.
153	Error	Actuator min / max stroke switch defect	**Actuator min / max stroke switch defect** Actuator switch did not change state in expected position. Check if the actuator switch feedback is connected or the feedback cable is damaged. If error persists, change corresponding actuator. **Additional info:** **Actuator ID:** ID of the actuator that triggered the error. See Table 30 for actuator ID and function assignment. **Actual position:** Actual position of the actuator that triggered the error. **Absolute min / max position:** The absolute min / max position of the actuator closest to the actual position. If the actual position is below 50% the min position is indicated, otherwise the max position is indicated. **Exception counter:** Indicates how many of the same errors are active.

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
154	Error	Actuator speed error	**Actuator speed error** Actuator is not moving or speed deviates too much from the expected speed. Check if the actuator position feedback is connected or the feedback cable is damaged. If error persists, change corresponding actuator. **Additional info:** **Actuator ID:** ID of the actuator that triggered the error. See Table 30 for actuator ID and function assignment. **Actual position:** Actual position of the actuator that triggered the error. **Absolute min / max position:** The absolute min / max position of the actuator closest to the actual position. If the actual position is below 50% the min position is indicated, otherwise the max position is indicated. **Exception counter:** Indicates how many of the same errors are active.
155	Error	Actuator direction error	**Actuator direction error** Actuator moves towards the wrong direction. **Additional info:** **Actuator ID:** ID of the actuator that triggered the error. See Table 30 for actuator ID and function assignment. **Actual position:** Actual position of the actuator that triggered the error. **Absolute min / max position:** The absolute min / max position of the actuator closest to the actual position. If the actual position is below 50% the min position is indicated, otherwise the max position is indicated. **Exception counter:** Indicates how many of the same errors are active.
156	Error	Actuator feedback supply shorted	**Check actuator feedback wiring for any damages and exchange affected actuator.**
158	Anomaly	Memory position invalid	**Memory position contains inconsitent data or position cannot be reached.**

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
159	Error	Minimum actuator stroke length error	**At least one actuator did not reach the minimum stroke length during the calibration process.**
160	Error	Minimum actuator travel time error	**At least one actuator did not reach the minimum travel time during the calibration process.**
161	Error	Actuator calibration data invalid	**Invalid data detected during the calibration process.**
162	Error	Internal supply of actuator feedback is out of tolerance	**Internal power supply of feedback out of tolerance** 1. Turn chair off 2. Inspect seat module connections 3. Turn power on 4. If error persists, change actuator module
163	Error	Actuator feedback supply out of tolerance	**The actuator feedback supply voltage is out of tolerance.** 1. Turn power off 2. Disconnect all actuator feedback cables. 3. Turn power on (Actuator feedback errors will be shown) 4. If error persists with disconnected feedbacks, change the actuator module, otherwise see point 5. 5. Reconnect the actuator feedback cables one at the time. 6. If error occurs while reconnecting the feedback cables, unplug the feedback that triggered the error 7. Reconnect the remaining actuator feedback cables one at the time. 8. Change the actuator that triggers the error.
203	Error	Pre drive test error	**Pre drive test error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
204	Warning	Communication error	**Communication error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
204	Error	Communication error	**Communication error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
205	Warning	Memory error	**Memory error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
206	Warning	Data error	**Data error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
206	Error	Data error	**Data error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
208	Warning	Supervision error	**Supervision error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
208	Error	Supervision error	**Supervision error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
209	Warning	Supervision software download error	**Supervision software download error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
212	Warning	Reset to default values	**Reset to default, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
213	Warning	Parameter database restored	**Parameter restored, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
214	Warning	Database load error	**Database load error, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on

Table 29. Fault List (continued)

Fault Code	Type	Description	Recovery Steps
215	Warning	Parameter database not saved	**Database load error, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on
220	Information	Processing firmware package	**Firmware package is analyzed and checked before installing.**
220	Information	Clear & repair resources in progress	**Resources where cleared and filesystem repaired.**
220	Fault	Firmware package is invalid. Please reload firmware package.	**Firmware package is invalid. Please reload firmware package.**
221	Error	Gyro / accelerometer (IMU) fault	**Gyro / accelerometer fault** (IMU: Inertial measurement unit)
223	Error	Software error	**Software error detected, please reboot system** 1. Turn power off 2. Wait 5 seconds 3. Turn power on 4. If error persists, call your local dealer.

Actuator ID and Function Assignment

Some fault recovery steps include references to actuator IDs and corresponding actuator functions. The following table describes the actuator IDs and functions.

Table 30. Actuator IDs and Actuator Functions

Actuator ID	Actuator
1	Tilt
2	Recline
3	Elevate
4	Left leg
5	Right leg
6	Legs
7	Back
8	AFP elevation
10	AFP
11	AFP articulation

Table 30. Actuator IDs and Actuator Functions (continued)

Actuator ID	Actuator
12	User function 1
13	User function 2
14	User function 3
15	User function 4
16	User function 5
17	User function 6
18	User function 7
19	User function 8
20	User function 9
21	User function 10
22	Anterior tilt
23	Standing

A — Programmers

The following programming applications and connection options are available for the enAble X1 system:

- *ECON-W* is a Microsoft Windows PC application. ECON-W is connected through the XLR port, Bluetooth, or Remote Diagnostics.
- *ECON-i* is an iOS application that is connected through Bluetooth only.

Cloud Account

For all programming devices, cloud account registration is required. Use the following link to create a new account. Contact your distributor or OEM if assistance is needed.

https://ecs.curtis.ch/#/account/registration

The cloud account determines the programming access level. Once the account is created and authorized, a programming device can be linked to the account when you login to an ECON application from a Windows or iOS device. A limited number of ECON devices can be registered with each cloud account.

Access Level

There are four access levels. The access levels define the available programming parameters and functionality. The access level is connected to the cloud account registration. The following table describes the access levels.

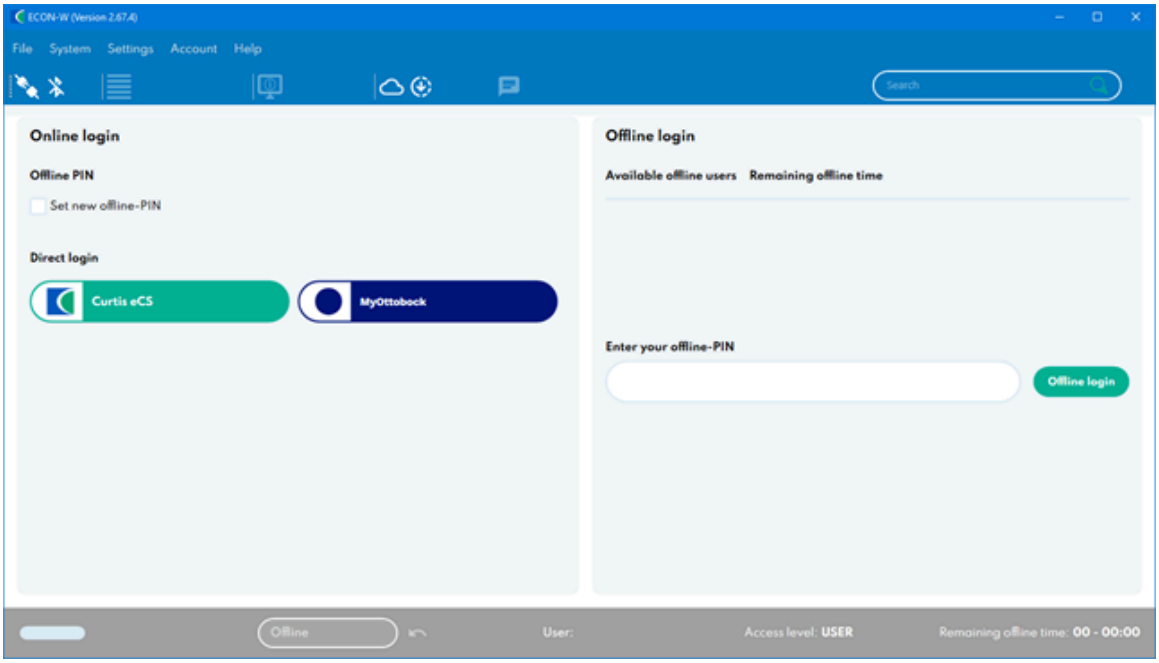
Access Level	Description
User	Intended for the power wheelchair user. User is the most restrictive access level, and allows for setting up environmental control. The User access level also allows display and audio adjustments. No cloud account registration is required for User access level, only an ECON programming device is needed.
Dealer	Intended for the provider of the power wheelchair. The Dealer access level allows basic drive profile tuning, adding seat configurations (actuators, restrictions), and access to diagnostic tools.
Subsidiary	Intended for the power wheelchair manufacturer's subsidiaries. The Subsidiary access allows battery parameter adjustment and full customization in the seat configuration.
OEM	Intended for the power wheelchair manufacturer. OEM is the highest access level, and allows full drive and seat customization.

Note:

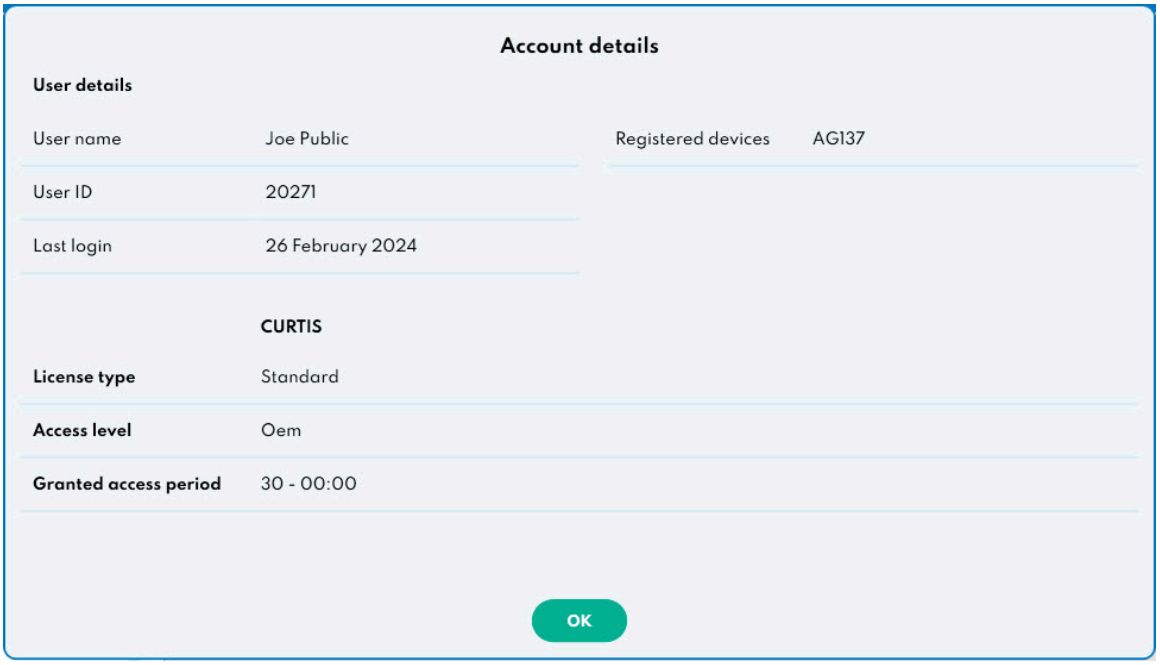
Each access level includes all of the programming parameters and functionality of the access levels below.

Registering Programming Devices

With an active cloud account, a Curtis Instruments programming device such as ECON-W or ECON-i can be registered. When you open an ECON programming device, you will be prompted to log in.



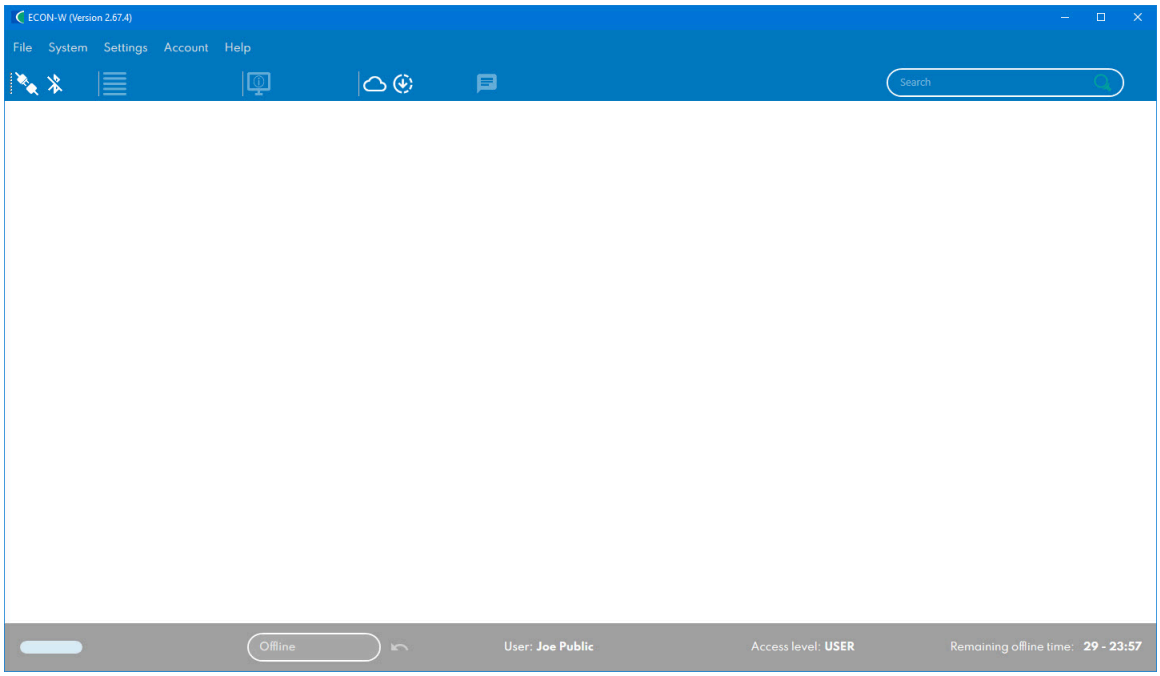
After you log in with a cloud account, the programming device is registered with the account.



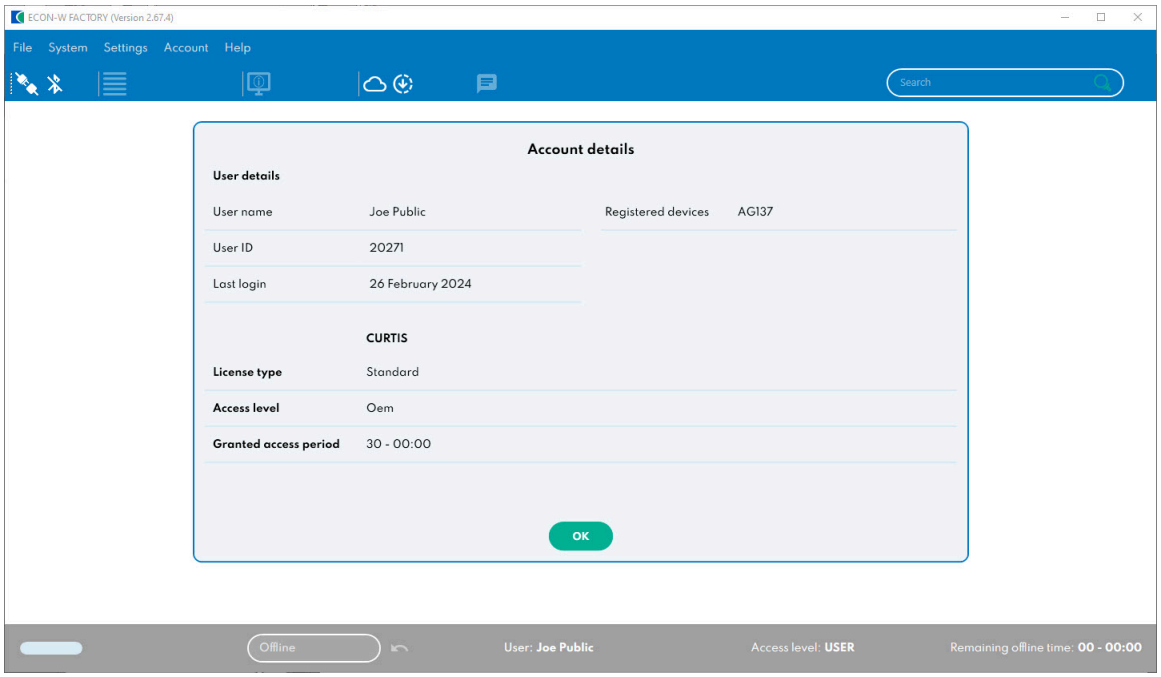
ECON Programmers

An ECON application is a powerful programming tool that enables the programming and diagnostic capabilities of the enAble X1 system. When you open an ECON application, you are prompted to login. After the login, the appropriate access level for the programmer is obtained from the cloud account. If you do not log in, the programmer is restricted to the User access level.

Before you log in, the screen shows the Remaining Offline Time. Some of the icons in the top toolbar are not displayed.

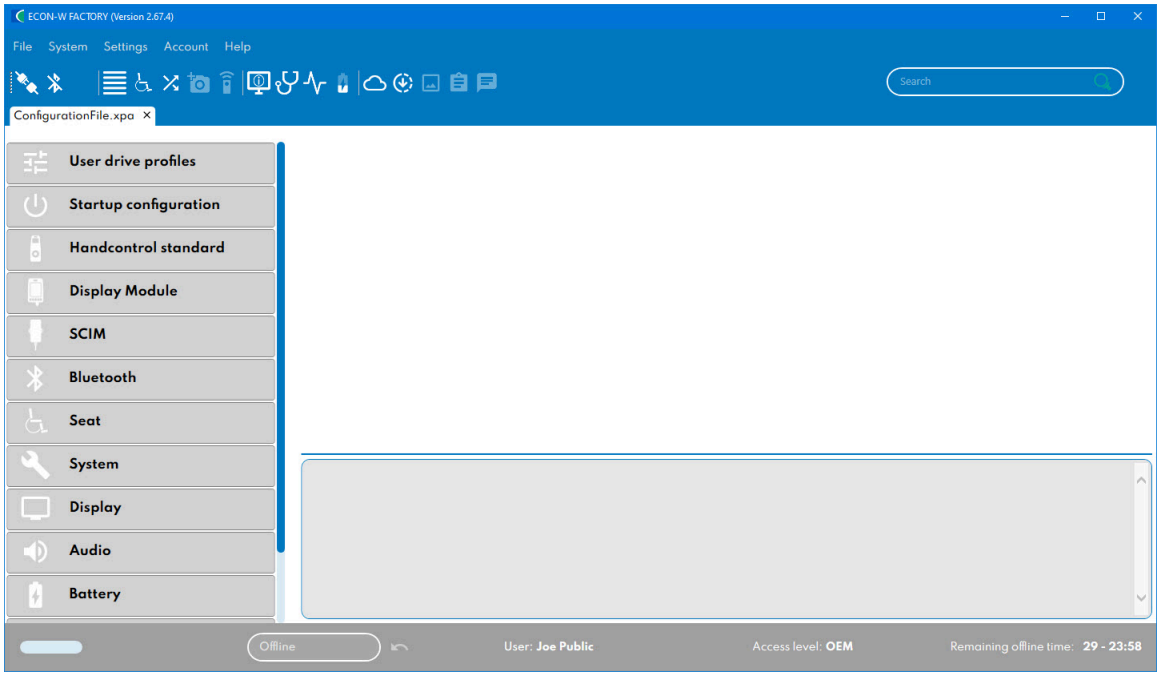


After you have logged in, the **Account Details** pop-up appears. The screen includes the username and access level.



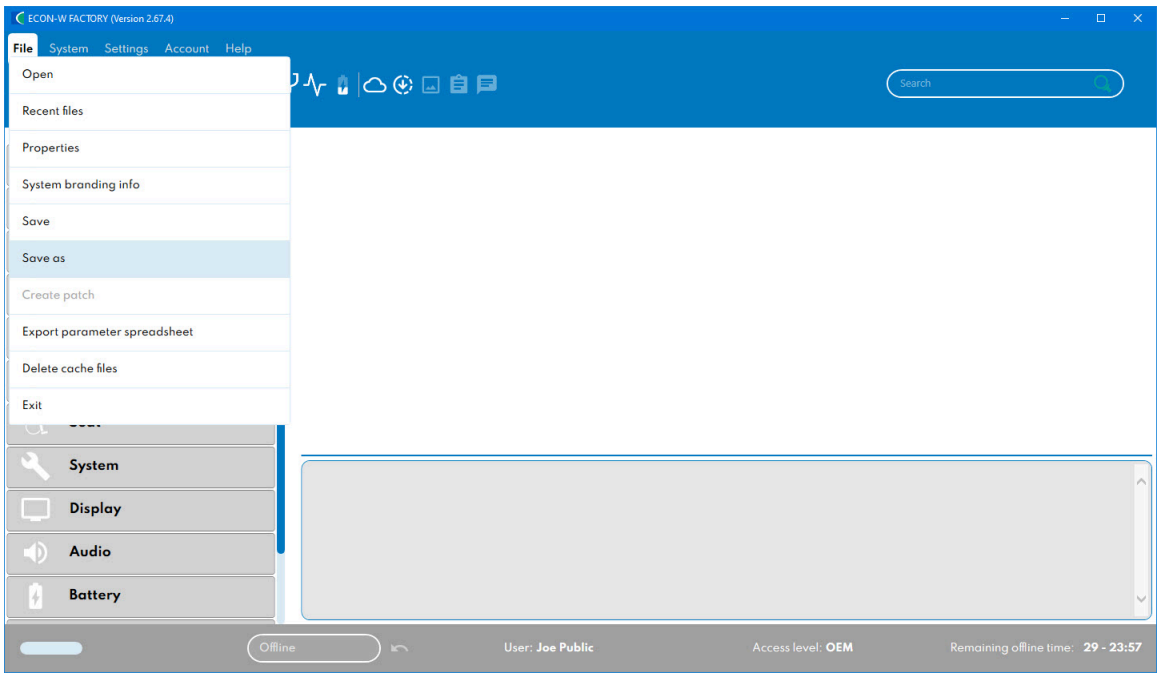
The Remaining Offline Time is the amount of time remaining before another login with an internet connection is required. Once this time expires, the access level is defaulted to User. After a successful login, the Remaining Offline Time is reset to its maximum allowed time.

After ECON is connected to a system or a configuration file is opened, the toolbar is populated and the bottom status bar is updated.

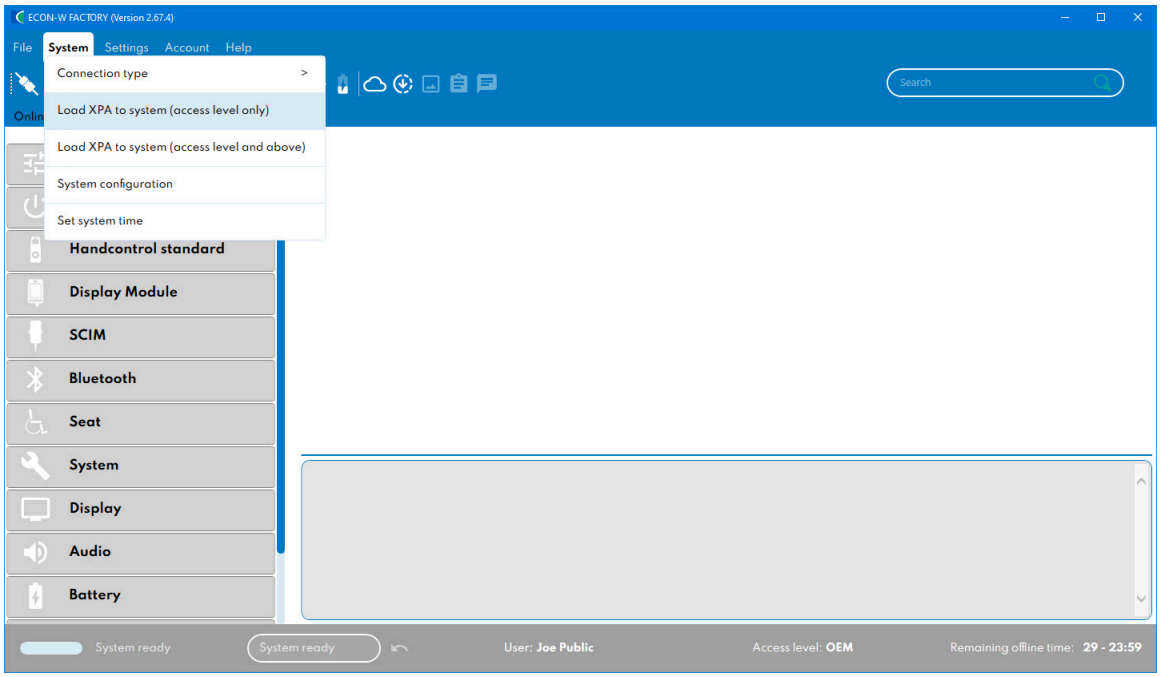


Viewing, Saving and Loading a Configuration

An enAble X1 system configuration can be viewed offline (disconnected from the system) or online (connected to the system). The **File** menu allows you to save a configuration that can be opened for viewing or loaded to another system.



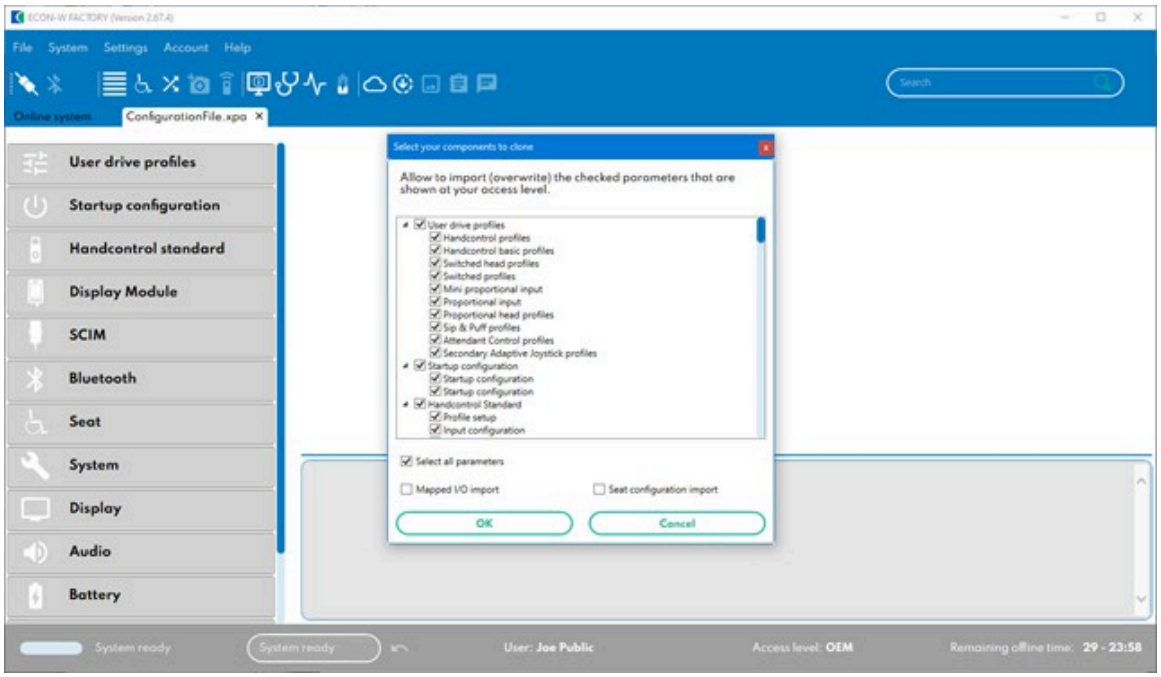
The **System** menu allows you to load a configuration.



The **System** menu contains two options for loading a configuration:

- **Load XPA to system (access level only)**: Loads the selected XPA file to the current connected system at the current access level. For example, if the access level is Dealer and this load option is selected, only parameters for the Dealer access level and below will be loaded.
- **Load XPA to system (access level and above)**: Loads the selected XPA file to the current connected system at all access levels. For example, if the access level is Dealer and this load option is selected, parameters for all access levels, including levels above Dealer, will be loaded.

Once a load option is selected, a popup appears. The popup allows you to specify whether only certain parameter groups or the full configuration is loaded. In addition, mapped I/O and seat configuration can be loaded.



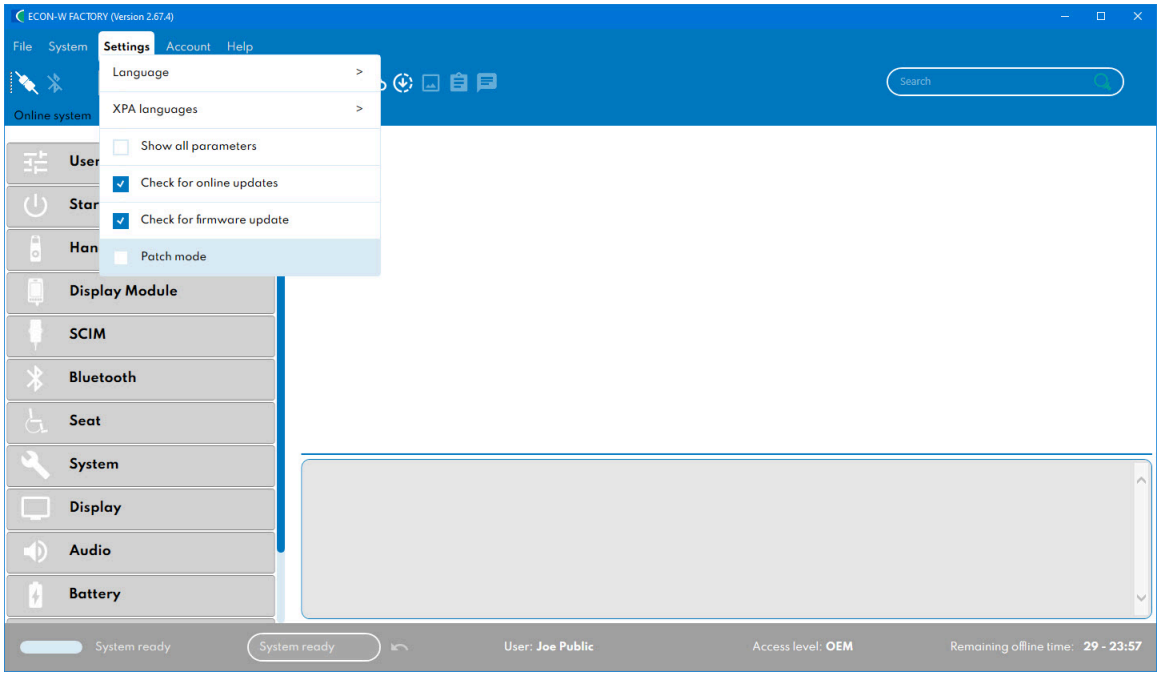
Note:

A limited set of parameters are non-clonable. These parameters will not be written to an online system, regardless of which load option is selected. For a list of non-clonable parameters, contact Curtis Instruments, Inc.

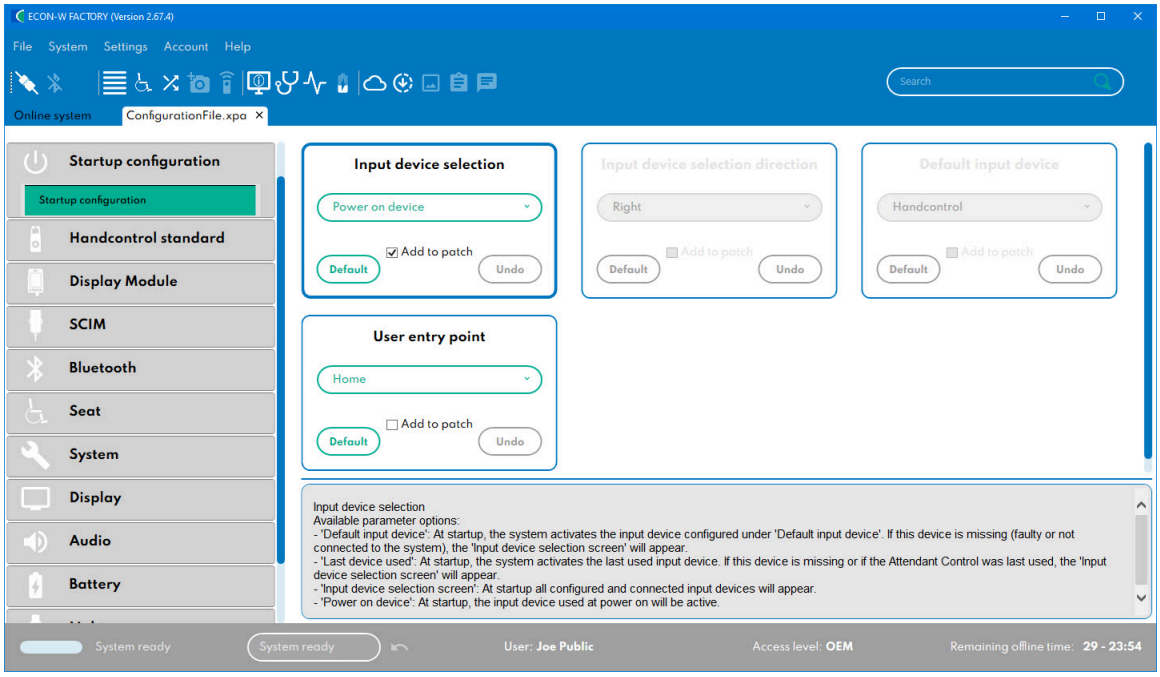
Patch Mode and Creating a Patch

Patch mode allows programmers that have the OEM access level to create a configuration that loads only specific parameters. A patch can be created from an online or offline configuration. Take the following steps.

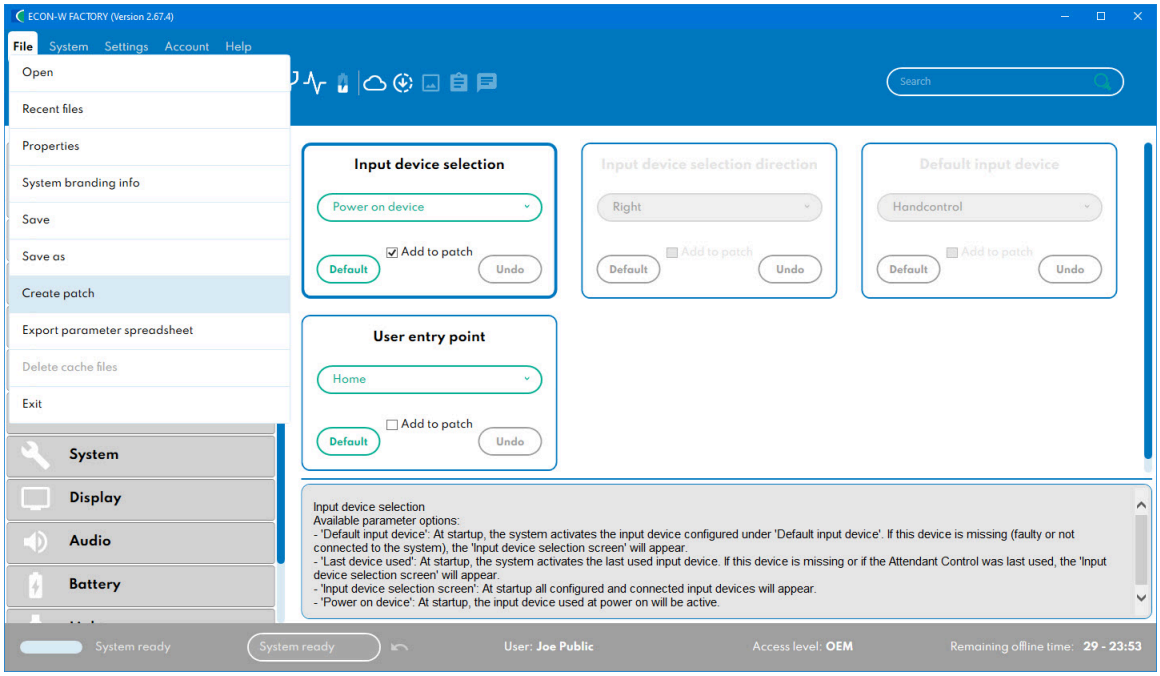
1. Select the **Settings** menu, then select the **Patch mode** option.



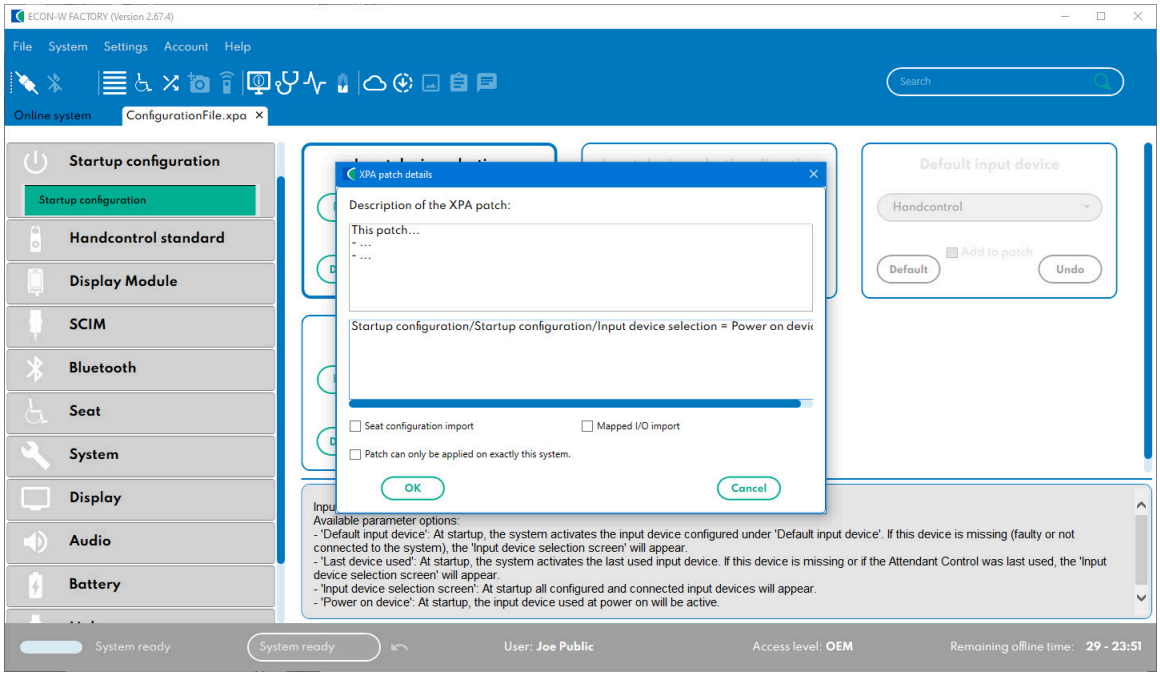
2. Each parameter will now include a selectable **Add to Patch** option. Select **Add to Patch** for each parameter to be included in the patch. There is no limit to how many parameters can be added. In the following example, the INPUT DEVICE SELECTION parameter will be included in the patch.



3. After the desired parameters have been selected, create the patch by selecting **Create Patch** from the **File** menu.



4. After **Create Patch** has been selected, the **XPA Patch Details** screen is displayed. The screen allows you to confirm the patch details before saving the configuration, and lists the parameters and values that the patch will include.



You can also do the following with this screen:

- Add a note that describes the patch.
- The **Seat Configuration Import** option specifies whether seat configuration is added to the patch.

- The **Mapped I/O Import** option specifies whether Mapped I/O is added to the patch.
- The **Patch can only be applied on exactly this system** option specifies whether the patch can only be loaded to the exact system and will not be loaded on any other system. ("Exact system" means that the modules and serial numbers in both systems match.)

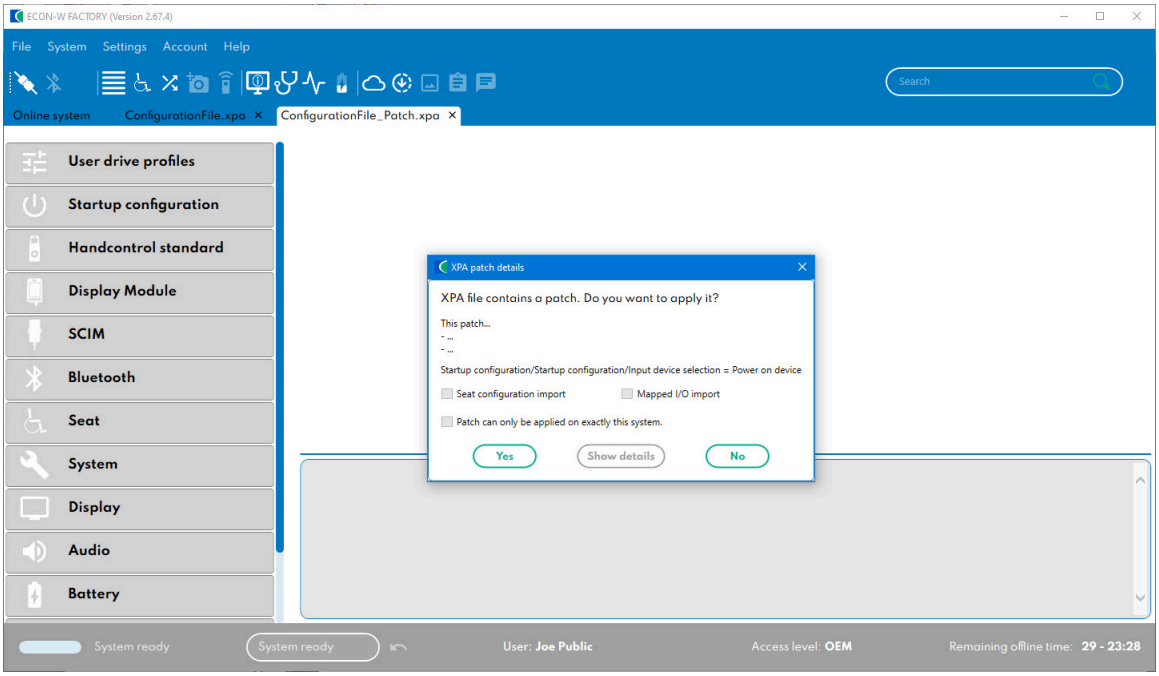
WARNING:

If **Patch can only be applied on exactly this system** is selected, non-clonable parameters can be patched to an online system. For a list of non-clonable parameters, contact Curtis Instruments, Inc.

5. After you select a load option, press **OK** to save the patch, otherwise press **Cancel**.

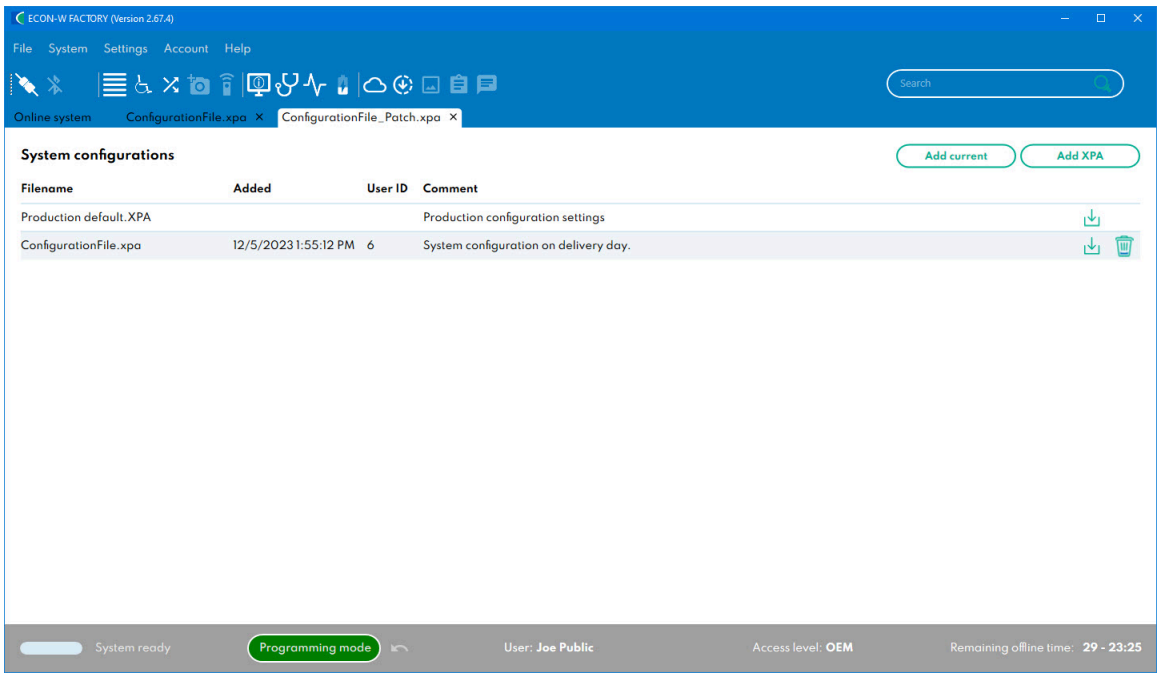
Loading a Patch

To load a patch, open the patch file by selecting **File > Open**. A popup indicates that the file contains a patch, and prompts you to specify whether the patch should be loaded to the current connected online system. You can view a summary of the patch by pressing **Show Details**.



System Configuration

The system configuration tool allows programmers with Dealer access level and higher to retrieve and store configuration files for an online system. To access the tool, select **System Configuration** from the **File** menu.



Note:

The *Production default.XPA* configuration can be loaded only through a special production process, not through a programming device. This configuration is stored in the Powerbase and cannot be deleted.

Other configurations can be added to the system:

- To add the current configuration of the system to storage, press **Add current**.
- To save another local configuration to storage, press **Add XPA**.

To retrieve a configuration for viewing, use the download arrow to the right of the configuration. Any configuration stored through the System Configuration tool can be deleted.

Note:

Using the System Configuration tool does not change any parameter settings of the online system. The tool manages stored configurations only.

Deleting Cache Files

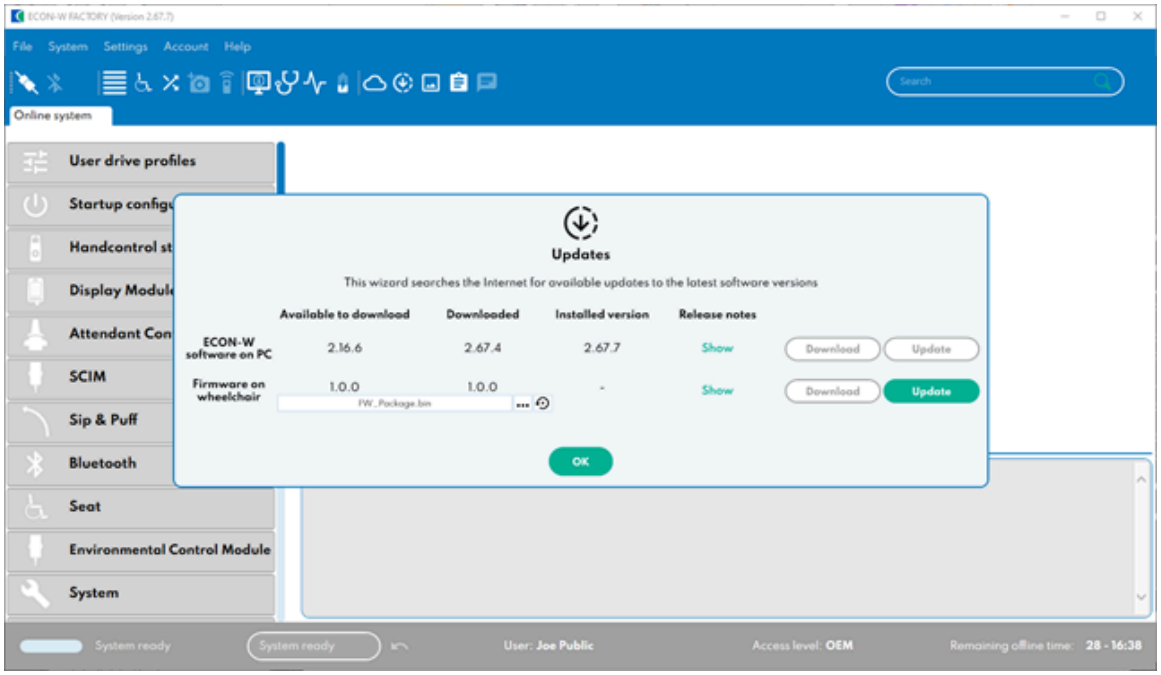
To delete cache files, select **Delete Cache Files** from the **File** menu. Deleting the cache files cleans up local files related to ECON-W, such as firmware.

Note:

For smartphone ECON apps, use the phone's settings to delete the cache.

ECON Programmer Update

If a new ECON-W version is available, it can be downloaded and updated via a web update. Press the **Updates** icon in the top toolbar to access the **Updates** screen. Use the screen to download and update a new version.



The web update also allows you to download enAble X1 system firmware (if available).

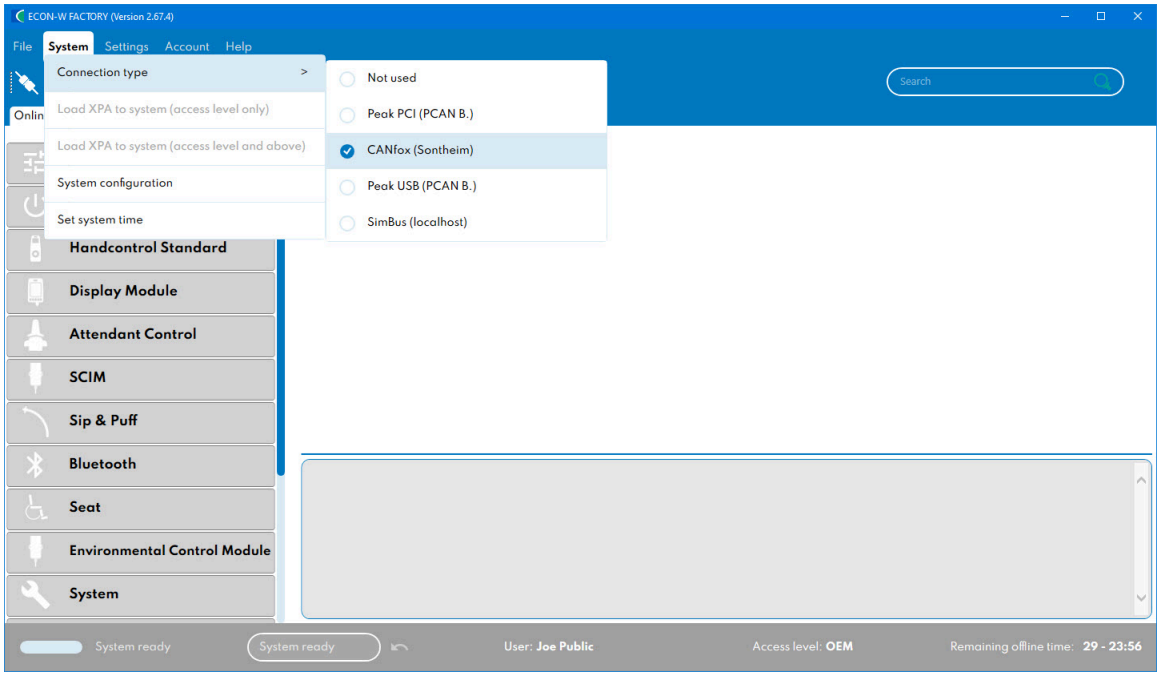
Programmer Connection Options

There are multiple ways to connect to an enAble X1 system:

- ECON-W allows CAN bus (wired), Bluetooth, and Remote Diagnostics connections.
- ECON-i allows Bluetooth connections only.

The Display Module supports Bluetooth connections. The *enAble X1 User Manual* describes how to pair the Display Module with a device that contains an ECON application.

For CAN bus connections, the default CAN dongle used for wired connection is the CANfox Sontheim cable. The connection type must be specified in the **Connection Type** submenu of the **Settings** menu. **Connection Type** includes menu items for all the supported dongles.



B — System Specifications

The following topics describe the system specifications.

Battery Specifications

Nominal Voltage	24V
Operating Voltage Range	17–33V
Maximum Voltage	35V

Note:

When the battery voltage falls below 21V, current output is reduced to preserve battery life.

WARNING:

Applying voltage higher than the maximum rating may cause permanent damage to all system components.

WARNING:

The internal battery fuse in the Powerbase may not trip at low battery voltage.

Charging

The maximum bus current while charging through the enAble X1 system is 13Arms continuous.

The charger used should match the selected battery type, voltage, and capacity. The charger manufacturer's instructions should be followed for proper operation, maintenance, and cleaning.

Note:

Using a higher-rated charger may cause permanent damage to all system components.

Environmental Specifications

Ambient temperature range (storage)	–40 to 70°C
Ambient temperature range (operation)	–25 to 50°C
Ambient humidity range (operation)	0 to 95% RH

Cable Specifications

The following tables describe specifications for cables commonly used in the enAble X1 system. For more information, please contact Curtis Instruments.

Table 31. Standard Bus Cable

Conductor	Gauge	24AWG x 2Pair	16AWG x 2 Cond.
	Stranding / Material	41 x 40TC	65 x 34TC
Insulation	Material	LD-PE	SR-PVC
	Outer Diameter (mm)	1.1 ±0.1	2.2 ±0.2
	Color	• One Pair: Orange, Brown • Two Pair: Blue, Yellow	Black, White
Outer Jacket	Material	PVC	
	Outer Diameter (mm)	6.4 ±0.2	
	Color	Black matte satin surface	

Table 32. Low-Power Bus Cable (Pigtails)

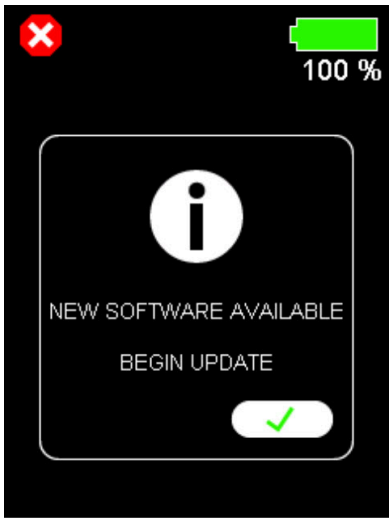
Conductor	Gauge	24AWG x 3Pair
	Stranding / Material	41 x 40TC
Insulation	Material	LD-PE
	Outer Diameter (mm)	1.1 ±0.1
	Color	• One pair: Orange, Yellow • Two pair: Blue, Brown • Three pair: Black, White
Outer Jacket	Material	PVC
	Outer Diameter (mm)	6.2 ±0.2
	Color	Black matte finish

Table 33. Curly Cable (e.g., Attendant Control)

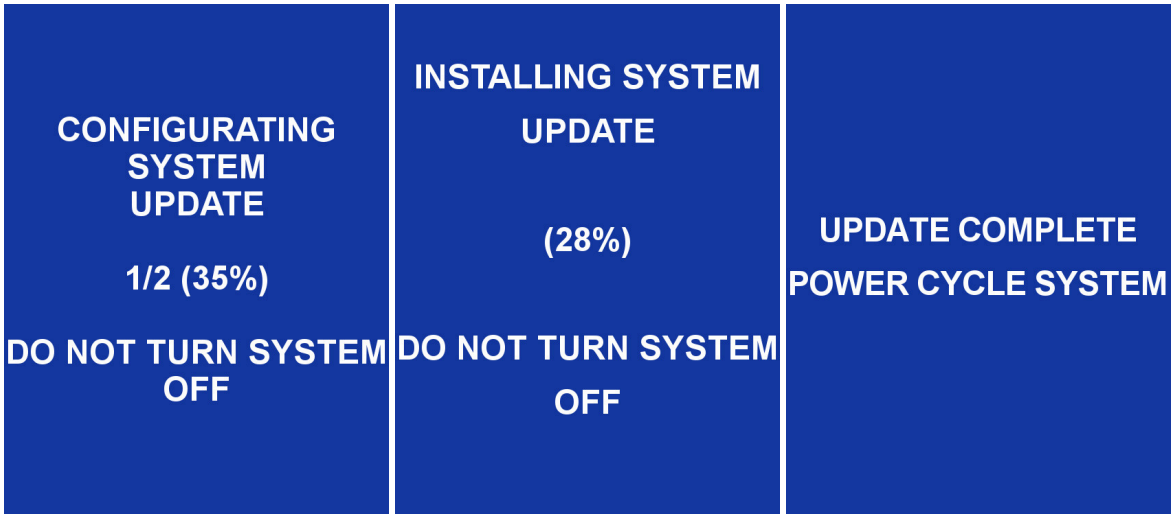
Conductor	Gauge	24AWG x 3Pair
	Stranding / Material	41 x 40TC
Insulation	Material	SR-PVC
	Outer Diameter (mm)	1.1 ±0.1
	Color	• One pair: Orange, Yellow • Two pair: Blue, Brown • Three pair: Black, White
Outer Jacket	Material	PU
	Outer Diameter (mm)	6.0 ±0.25
	Color	Black

C — enAble X1 Firmware Compatibility And Updates

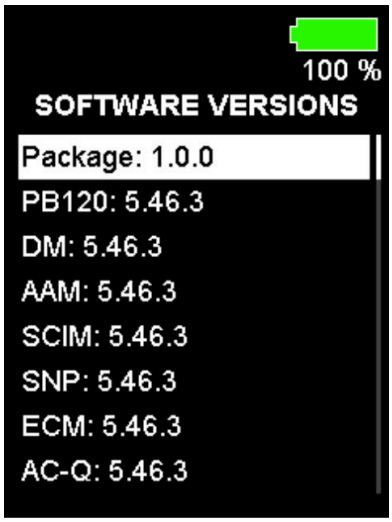
Updating the enAble X1 system firmware can be done using any programming device. The firmware is loaded to the internal memory (see Configuration Management to ensure proper installation), and becomes available to install on the next power cycle.



The installation begins once the update is initiated, and the firmware is distributed to each connected module via an automatic self-update.



Then, the firmware pack and module versions can be seen in the **Auxiliary** > **System Information** > **Software Versions** screen.



It is recommended to use the latest firmware to ensure the newest features of the system are available.

Note:

If the Charger Inhibit or a Drive Restriction due to seat position is active, a firmware update will not be shown if available.

Note:

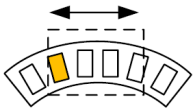
It is not possible to downgrade firmware.

The following topics describe using ECON for updates and exchanging modules with different firmware.

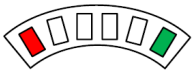
Hand Control Basic Firmware Updates

The following list describes the Firmware Update process when the Hand Control Basic is the input:

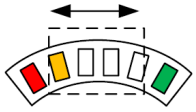
- When the system is powered on, it checks whether the installed firmware and the uploaded firmware package are the same version. If the versions differ, the four middle BDI LEDs blink sequentially:



- If a Firmware Update is pending after power has been cycled, the left red and right green BDI LEDs are steadily on:



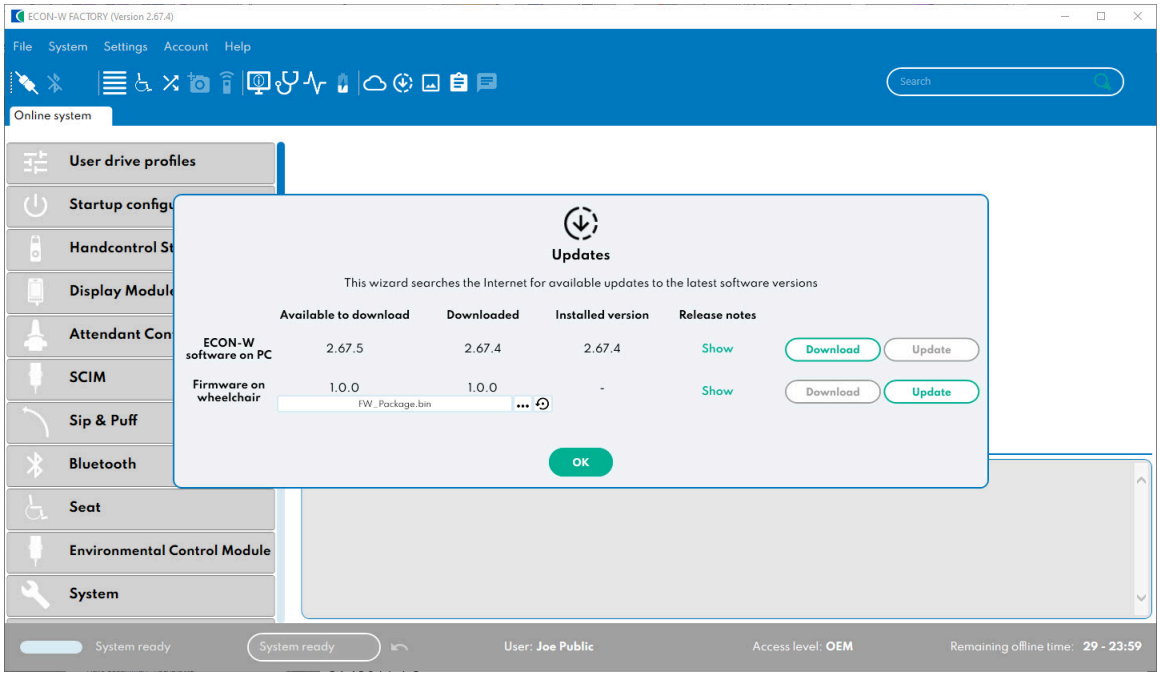
- To install the new firmware, deflect the joystick forward. During the update cycle, the left and right BDI LEDs are on, and the four middle LEDs blink sequentially:



- After the new firmware is installed, power cycle the system. To indicate that a power cycle is required, the BDI LEDs flash simultaneously at a frequency of 2Hz.
- If the Firmware Update fails, the left BDI LED is steadily on and the other BDI LEDs are off.

Using ECON

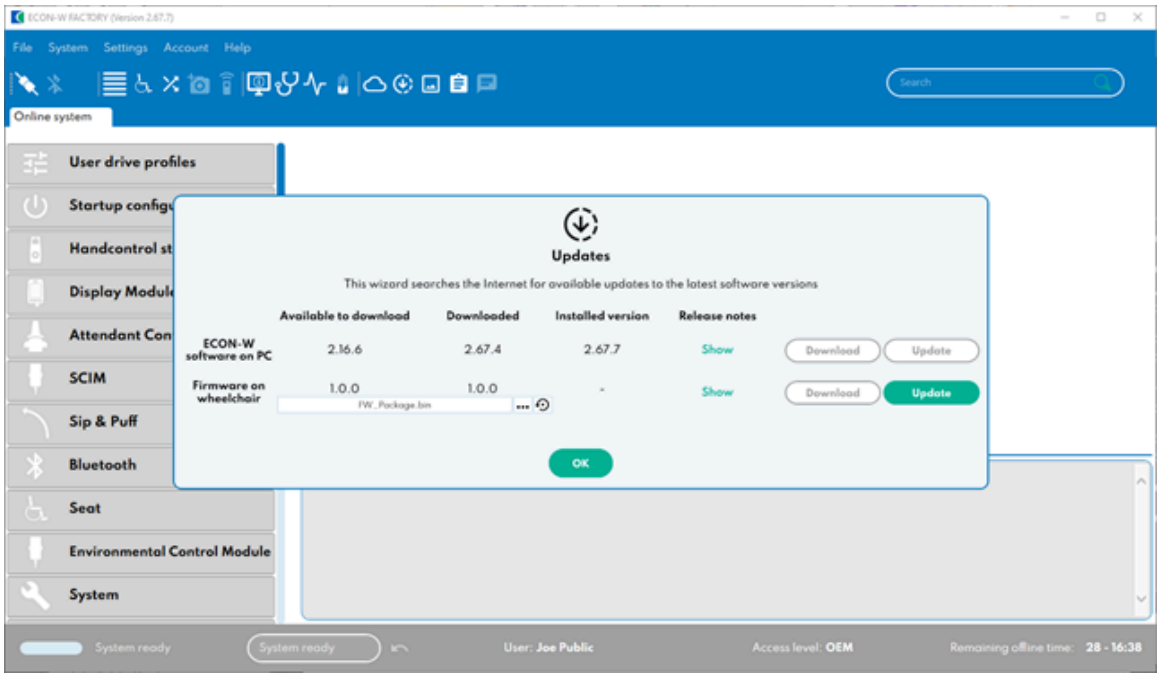
To download the latest firmware using ECON-W, the pack must first be obtained from the web server. Using ECON-W, select the Updates icon from the top bar.



Note:

Web Update will be prompted automatically if Check for Online Updates is enabled from the Settings drop-down menu.

Next, connect to an enAble X1 system and choose the Firmware Update icon from the top toolbar. A pop-up will be shown to start downloading the firmware to the systems internal memory.



Note:

Firmware Update will be prompted automatically if auto check for firmware package update is enabled from the Settings drop-down menu.

Exchanging Modules Of Different Firmware

All enAble X1 modules connected to a system must utilize firmware versions from the same firmware pack. The firmware on the Primary Module's Internal memory should always be up to date.

If a replacement module is added to an existing system and that module has older firmware, it will receive an update from the firmware pack installed on the Internal memory.

If a replacement module is added to an existing system and that module has newer firmware, a firmware update of the system is required.

Note:

In some cases, if system modules are not utilizing firmware from the same firmware pack, an error will be shown and the system will be inoperable until the firmware is updated.

D — File Extensions

File Extension	Description
.XFP	System firmware pack (all modules)
.XFW	System firmware (single module only)
.XPA	System configuration

E — Spare Parts And Accessories List

Table 34. Accessories List

Description	Part Number
Multiplier cable, m/m/m/f	17881359-02-01
Multiplier cable, m/m/f/f	17881360-02-01
Bus cable, 0.3m, f/f	17881361-01-02
Bus cable, 1.1m, f/f	17881361-01-01
Bus cable, 1.1m, m/f	17881362-01-02
Bus cable, 1.5m, f/f	17881361-01-03
Bus cable, 0.41m, m/f	17881362-01-01
Y Splitter Bus Cable	17881379-01-01
Charger/programmer harness, 1m (XLR)	17880701
Charger harness, 1m (MCP)	17976701
Motor connector housing	37383-03
Battery connector housing	37384-02
Boot, Motor connector	39433
Boot, Battery connector	39432
Charger/programmer Socket	17880310
Kit Connector 1740/1750/1760 (UL)	381570002
MCC Charger Cable Assembly	17969363-01
Charger Adapter Cable Kit (MCC-XLR)	17969702
Magnetic Charger Cable Wall Holder	17969704

Table 35. Spare Parts List

Description	Part Number
Joystick SK 175-002 SPI	18139MXYD-0002
Soft spring SK 175-141 incl. Circlip	17518033-02
Knob Joystick	17519114-01
Gaiter SK 175-150	17518031-02
Keypad Complete for HCS-x1	17969352-04

Table 35. Spare Parts List (continued)

Description	Part Number
Holster for PSM	17951300-01
Case bottom coated HCS	17969300-02-01
Case bottom uncoated HCS	17969300-02-03
Spare Kit Enhanced Switch Module	17966355-01
USB-CAN Programmer cable	17876300-02
Spare Kit Hand Control HCS-x1	17969353-XX