MC-2 Generic

OEM Manual

Curtis Instruments AG

Revision Overview

Revision	Date	Author	Changed
1.0	13.9.2000	Thomas Laubscher	First issue
1.10	21.12.00	Matthias Holenweg	Clerical corrections.
1.11	05.04.01	Matthias Holenweg	Adding Controller with light, Stand Alone, Head Control update drawings
1.20	21.09.01	Matthias Holenweg	Major changes of outline and contents
1.21	19.10.01	Matthias Holenweg	Adding Chapter 11 to 15
1.22	17.12.02	Matthias Holenweg	Adding Controller A/L, removing Controller with light

Release

This document was released

on: .....

by: .....

Contents

1 SYSTEM OVERVIEW

Introduction

The MC-2 Electric Mobility System is a high-end power wheelchair control which provides the highest degree of flexibility coupled with powerful CAN bus technology.

Because of Curtis' commitment to continuous improvement and product development, all information in this manual is subject to change without prior notice.

Minimum Wiring – Maximum Flexibility

The CURTIS MC-2 is a wheelchair control that offers maximum flexibility with minimum wiring.

The secret is a bus structure that allows the devices to be connected to any free bus connector in any sequence. Not only the devices, but also the battery charger, can be connected anywhere in the system.

Safety Comes First

The bus structure provides communication and power to the devices. The DMS and KEY lines represent an advanced safety feature.

The KEY Line provides ON/OFF switching of the entire system, while the DMS Line disables any movement when no input command is present.

A Variety of Input Devices

Besides the standard Hand Control, Specialty Input devices such as Sip & Puff, Stand Alone Joystick, and Headcontrol are provided. The switch interface on the LCD Display allows 1, 2, 3, or 5 switch controls to be connected.

The active input device also operates the optional seat actuators and motors or environment control channels. These auxiliary functions can be mapped to any of the four available AUX channels. If more than four channels are used, simply add the LCD Display for almost unlimited possibilities.

Individual Drive Modes

The system offers four drive modes, each of which can be programmed individually to achieve the desired drive response. Programming at the user level is possible using the standard input device in combination with the LCD display.

At higher levels (Service, Dealer, OEM) parameters can be set up using the Handheld Programmer or the PC Programming Station. The latter allows all the wheelchair's parameters to be stored to and retrieved from files.

Parameter Cloning and Software Update

Parameters or the complete software can be updated at the OEM site without the need to open the housing of the CURTIS MC-2 devices. Simply plug the PC Programming Station into the wheelchair and update the desired devices.

Choose Your Controller

The CURTIS MC-2 controller is available with an integrated driving light module or with integrated actuator outputs. Two power versions are available: 60 and 100 Amp.

MC-2 System

The figure below shows all the available modules connected to the MCP bus.

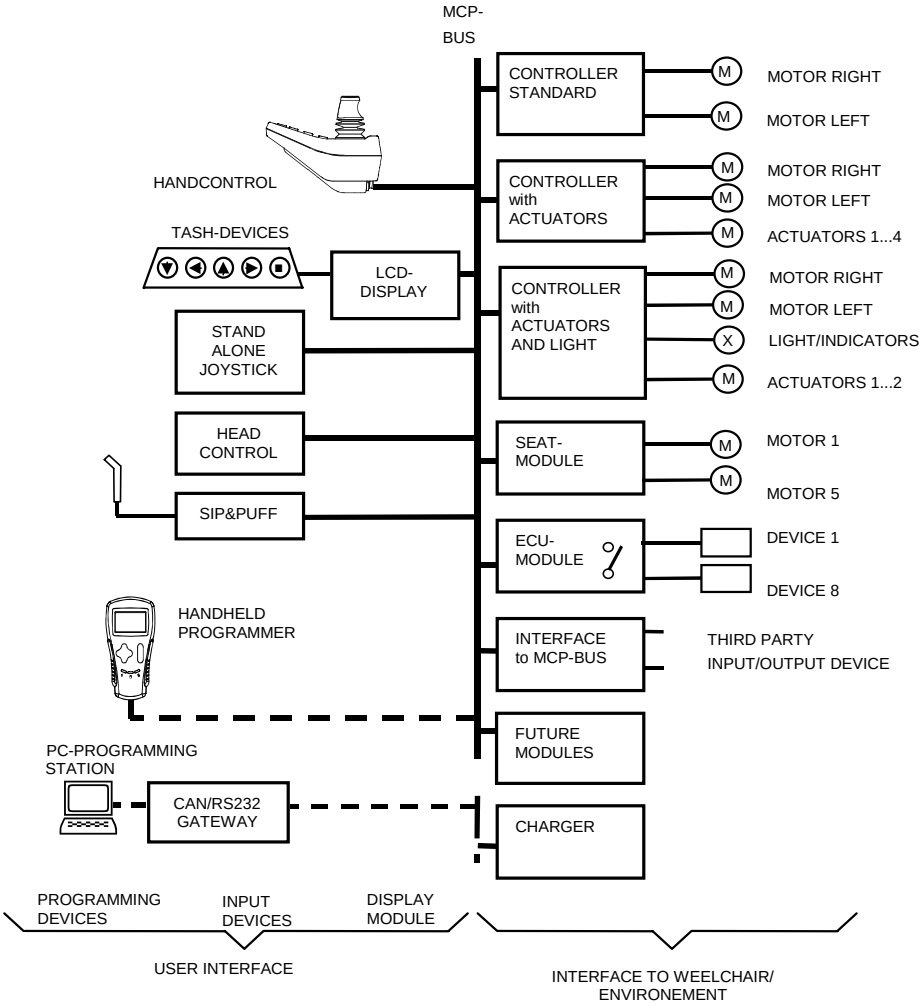


Fig. 1: *MC-2 System Overview*

System Configuration

The table below shows which combinations of devices are supported.

Table 1: *System Configuration*

1705-2010 Controller	1705-2013 Controller with Actuators	1705-2014 Controller with Act. and Light	1720-5010 Handcontrol	1720-5012 Handcontrol with Light	1712-6010 LCD			1711-5010 Sip and Puff	1710-5010 Stand Alone Joystick	1713-5010 Headcontrol	1720-5011 Attendant Control	1709-7018 ECU Module 8 channel	1708-7015 Seat Module 5 channel
					Configured for TASH 1,2,3 or 5 switch	Configured for Remote Switches	Remote Switches disabled, TASH 1,2,3 and 5 disabled						
X or X			X								O	O	O
X or X			X			X 1)					O	O	O
X or X			X				X 1)				O	O	O
X or X			X		X						O	O	O
X or X					X						O	O	O
X or X			X			X		X			O	O	O
X or X						X		X			O	O	O
X or X			X			X			X		O	O	O
X or X						X			X		O	O	O
X or X			X			X				X	O	O	O
X or X						X				X	O	O	O
X or X			X				X	X			O	O	O
X or X							X	X			O	O	O
X or X			X				X		X		O	O	O
X or X							X		X		O	O	O
X or X			X				X			X	O	O	O
X or X							X			X	O	O	O
		X		X							O	O	O
		X		X		X 1)					O	O	O
		X		X			X 1)				O	O	O
		X		X	X						O	O	O
		X			X						O	O	O
		X		X		X		X			O	O	O
		X				X		X			O	O	O
		X		X		X			X		O	O	O
		X				X			X		O	O	O
		X		X		X				X	O	O	O
		X				X				X	O	O	O
		X		X			X	X			O	O	O
		X					X	X			O	O	O
		X		X			X		X		O	O	O
		X					X		X		O	O	O
		X		X			X			X	O	O	O
		X					X			X	O	O	O

O = optional, [1)] = MFS (Multi-Function Switch) not functioning

Remarks:

This table is based on the devices currently specified. It may be adapted for future generic devices which are not known today.

If the Hand Control is operated without LCD, only four AUX channels can be accessed.

The Basic Features of the MC-2 System

I. The Specialty Input devices are: Stand Alone Joystick, Headcontrol, Sip & Puff, LCD Display configured as Tash Input.

II. The output modules are Seat Module and ECU Module.

III. The controller is the master and therefore necessary in every system.

IV. A maximum of one Controller can be connected to the system.

V. A maximum of one Hand Control can be connected to the system.

VI. A maximum of one Attendant Control can be connected to the system.

VII. A maximum of one Specialty Input device can be connected to the system.

VIII. A maximum of one LCD Display can be connected to the system.

IX. Every Specialty Input device requires an LCD Display with an MFS (Multi-Function Switch).

X. Without the LCD Display, the number of output channels is limited to four.

XI. In addition to a Specialty Input device, a Hand Control and an Attendant Control can be connected to the system.

XII. If an LCD Display is connected, all other displays (Hand Control, Attendant Control) are disabled.

Plug and Play

The modular MC-2 system can be easily extended with additional devices like Seat or Environmental Control Modules. It is possible to use alternate input devices with minimum reconfiguration.

Some examples of possible extensions

Initial system: Controller and Hand Control:

Full Plug and Play (no need to change any parameter)

adding an LCD Display

Partial Plug and Play (only execution of AUX assignment in PC Programming Station required)

adding a Seat Module

adding an ECU Module (Environmental Control Unit)

Initial system: Controller, Hand Control, and LCD Display:

Full Plug and Play (no need to change any parameter)

adding one or more Seat Modules

adding one or more ECU Modules

adding a Sip & Puff (together with MFS)

adding a Stand Alone Joystick (together with MFS)

adding a Headcontrol (together with MFS)

Partial Plug and Play (select number of Tash switches only)

adding a Tash input device (1-, 2-, 3-, or 5-switch Tash)

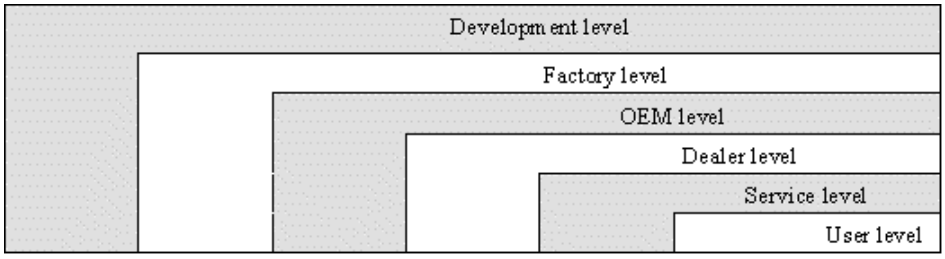
Access Levels

Access Levels apply to all menu entries of the MC-2 system. They are used to assign different user groups different rights to configure, program, and diagnose the MC-2 system. This is done for the following two reasons:

1) Safety: prevention of unsafe behavior due to wrong programming

2) Clarity: Overwhelming or useless information can be avoided

Fig. 2: *Access Levels*



With the Access Levels, each group can access the sub-set of parameters that is provided for it. Access Levels are defined separately for read and write access. At the lower Access Levels, parameters can be viewed but not modified.

Example: Users cannot see Fault Histories, which are useless to them. Service and Dealers can see them but are not allowed to delete them. Deleting Fault Histories is reserved for OEMs and above only.

Fully Programmable

The CURTIS MC-2 system allows many parameters to be adjusted in order to meet the characteristics of the wheelchair, the connected motors, and to achieve the desired drive response.

Two different programming tools are available, the Handheld Programmer and the PC Programming Station. The Handheld Programmer is mainly intended for Service and Dealers. The PC Programming Station is mainly used at the OEM and Dealer sites.

The Handheld Programmer offers all the basic functionality needed to program, diagnose, and test a CURTIS MC-2 system.

PC Programming Station's additional features

- ✓ Parameter storing and cloning via files.
- ✓ Matrix representation of parameter sets.
- ✓ Software updates of MC-2 devices via files.
- ✓ Export of fault statistics, fault histories, parameters, and memory contents to files.
- ✓ Logging of monitor values.
- ✓ Printing of device/wheelchair parameters, fault histories, memory contents, etc.
- ✓ Help screens for every single parameter and monitor value.
- ✓ Documentation interface to display any customer-specific documents.
- ✓ Two working levels: wheelchair and device level.
- ✓ Comfortable AUX assignment and Drive Restriction programming.
- ✓ Simulation (training mode) to operate the PC Programming Station locally.
- ✓ Optional MS-Access™ database for OEMs and Dealers.
- ✓ On-line user manual.

Software Update at the OEM

Because the software in the MC-2 devices is replaceable, the functionality of the MC-2 systems in the field can evolve hand-in-hand with the ongoing development. This protects your investment in the MC-2 system for a long period of time.

All MC-2 device software (in addition to the Stand Alone Joystick and Headcontrol) can be updated without the need to open housings or replace memory devices. The update is done over the bus cable, by simply connecting the PC Programming Station to the MC-2 system.

With the PC Programming Station, a binary file supplied by CURTIS, containing the new software to be programmed, can be downloaded.

For detailed instructions on how to execute the software update with the PC Programming Station, refer to the on-line help of the PC Programming Station.

Specifications

For device specifications refer to the following chapters.

Table 2: *Bus specifications*

Max. Bus length	10 m
Max. number of devices	10
Bus power line	13 A continuous

2 1705-X01X CONTROLLER

Overview

The CURTIS 1705-X01X dual permanent magnet motor speed Controller provides smooth and precise operating control for maximum user confidence.

The feel of the advanced closed-loop control algorithms gives the operator confidence in the handling, operation, and control of the wheelchair, whether it is traveling at full speed, on a steep hill, or climbing over a curb.

Fig. 3: *Curtis 1705-X012 Controller A/L*

The Controller is fully programmable for use in a wide range of wheelchair types and for a variety of user needs. Correct installation and programming are essential to ensure optimum performance and safety.

The Controller is required for every configuration of the modular CURTIS MC-2 system.

Variations

The Curtis 1705-301X Controller has 60 Amps per channel; the 1705-201X has 100 Amps per channel.

In addition to the basic Curtis 1705-X010 Controller, there are two special variants:

- 1705-X013 Controller with Actuator, which provides output for up to four actuators and inputs for limit switches or drive inhibit switches.
- 1705-X014 Controller with Actuators and Light, which provides output for two actuators and for light and indicators.

Features

- ✓ Four-quadrant, full-bridge, solid-state design.
- ✓ Drives dual DC Motors, front, middle or rear wheel.
- ✓ Compact, rugged housing provides the wheelchair designer with new opportunities for innovation.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Meets US and European Standards. The Controller is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.
- ✓ Easily and fully programmable using the Curtis Handheld Programmer or the PC Programming Station.
- ✓ Software update by OEM using any connector.
- ✓ The controller is internally protected against damage due to possible miswiring during installation, such as reverse battery connection and external short circuits.
- ✓ Thermally protected and compensated for stable output and for overheat protection.
- ✓ Thermal motor protection.
- ✓ Diagnostic information such as voltage, current, speed, distance, hour meter, faults (motors, brakes, battery) are available through any display module.
- ✓ The supervision capabilities of the Curtis Model 1705-X01X Controller prevents driving with defective brakes or wiring.
- ✓ Inhibit input prevents driving during charging.
- ✓ The feel of the advanced closed-loop control algorithms gives the operator confidence in the handling, operation, and control of the wheelchair, whether it is driving at full speed, on a steep hill, or climbing over a curb.
- ✓ The progressive brake control provides smooth and secure stops on both level and sloping surfaces (eliminates unwanted rollback).
- ✓ The motor current limit is smoothly reduced as the controller warms up, making maximum safe power available under all conditions.
- ✓ Power Saver shuts the controller off after a programmable time to preserve the battery.
- ✓ Model 1705-X013 with four integrated seat actuators. Simultaneous operation of up to two motors possible. Provides inputs for limit switches or drive inhibit switches. Controls one switch-type output which is an isolated relay contact, protected against overcurrent.
- ✓ Model 1705-X014 with two integrated seat actuators and light and indicator outputs. Provides inputs for limit switches or drive inhibit switches. Can also be used to control servo steering.

Installation and Wiring

Installing the Controller

The overall dimensions and mounting hole dimensions of the 1705-X01X CONTROLLER are shown in the figure below.

The Controller can be oriented in any position, but the location should be carefully chosen to keep the controller as clean and dry as possible. If a clean mounting location cannot be found, a cover must be used to shield the controller from water and dirt.

To ensure full rated output power, fasten the controller to a clean, flat metal surface with two screws.

Dimensions

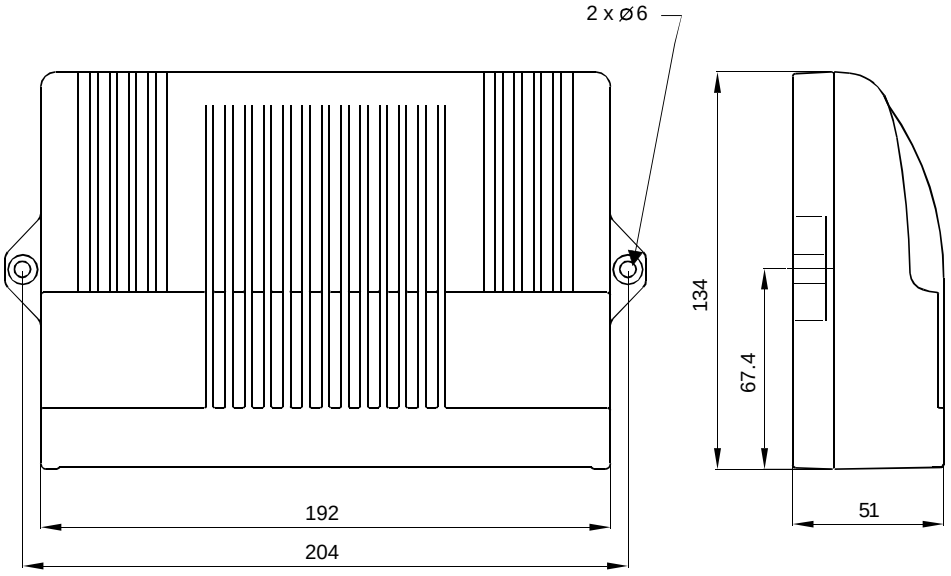


Fig. 4: *Mounting dimensions, Curtis MC-2 1705-X01X Controller*

Working on electric vehicles is potentially dangerous. Protect yourself against high-current arcs and gas leaks from lead acid batteries:

High-Current Arcs: Electric vehicles operate with very high power, and arcs may occur in the event of a short circuit. Always open the battery circuit before working on the motor control circuit. Wear safety glasses, and use properly insulated tools to prevent shorts.

Lead Acid Batteries: Charging or discharging generates hydrogen gas, which can build up in and around the batteries. Follow the battery manufacturer's safety recommendations. Wear safety glasses.

Wiring the 1705-X010 Controller

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

High-Current Connection

Make sure the connectors are tight (plugged in with the appropriate force applied). There is no need to connect the right-hand motor cable to M2. Use the 'Initial Operating Phase' flow chart to configure the motor.

The MC-2 /1288 Connector Set for power connection can be ordered as a separate part: Curtis p/n 17519022.

Wiring Diagram

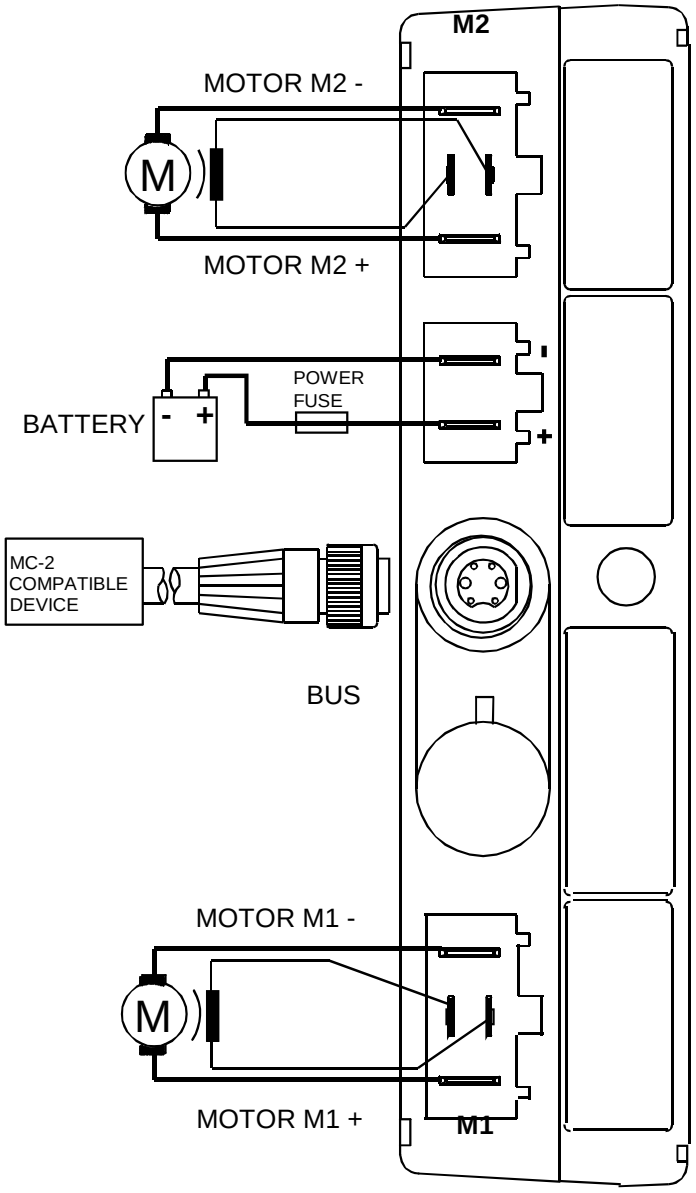


Fig. 5: *Standard wiring configuration for the MC-2 1705-X010 Controller*

Wiring the 1705-X013 Controller with Actuator

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Low-Current Connection

The D-Sub connectors provide control of the actuators. The mating connector for the switch input is a 9-pin D-Sub with socket contacts, and the mating connector for the actuators is a 15-pin D-Sub with pin contacts.

High-Current Connection

Make sure the connectors are tight (plugged in with the appropriate force applied). There is no need to connect the right-hand motor cable to M2. Use the 'Initial Operating Phase' flow chart to configure the motor.

The MC-2 /1288 Connector Set for power connection can be ordered as a separate part: Curtis p/n 17519022.

Wiring Diagram

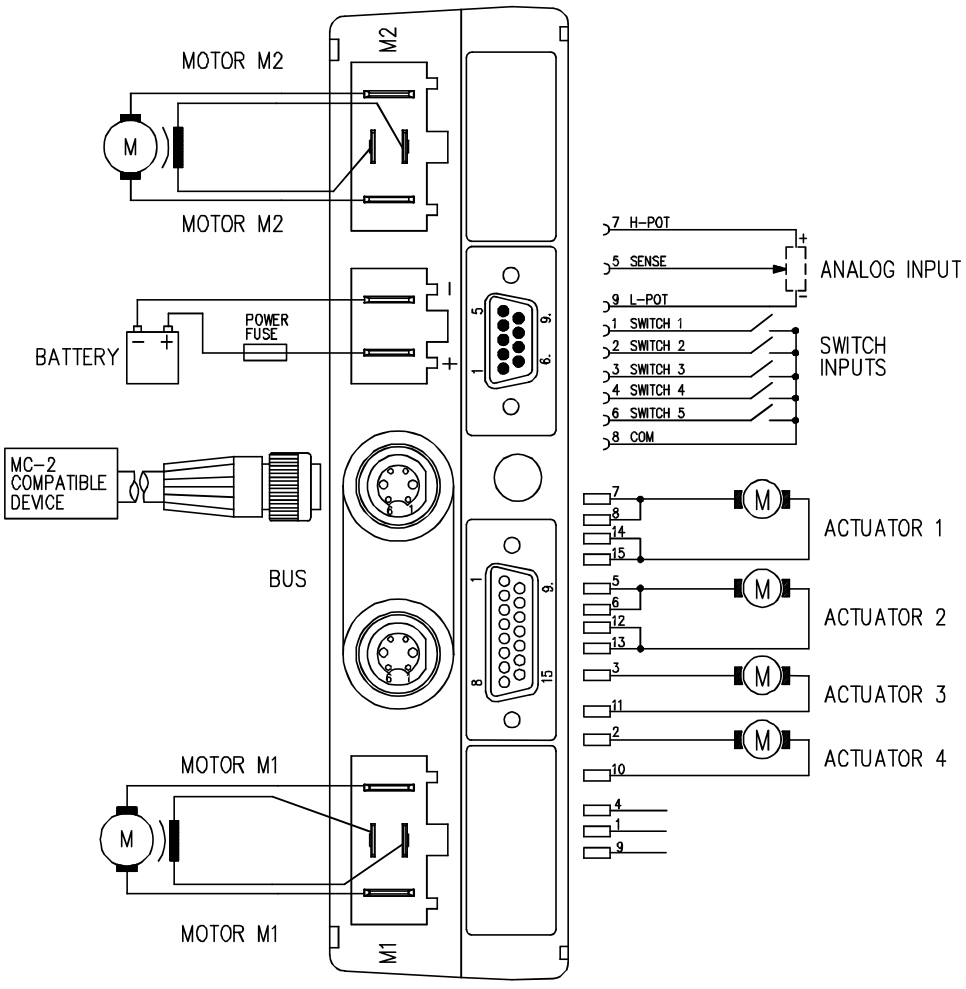


Fig. 6: *Standard wiring configuration for the MC-2 1705-X013 Controller with Actuator*

Wiring the 1705-X014 Controller with Actuators and Light

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Low-Current Connection

The D-Sub connectors provide control of the actuators and the light. The mating connector for the switch input is a 9-pin D-Sub with socket contacts, the mating connector for the actuators is a 9-pin D-Sub with pin contacts, and the mating connector for the light and indicators is a 15-pin D-Sub with pin contacts.

High-Current Connection

Make sure the connectors are tight (plugged in with the appropriate force applied). There is no need to connect the right-hand motor cable to M2. Use the 'Initial Operating Phase' flow chart to configure the motor.

The MC-2 /1288 Connector Set for power connection can be ordered as a separate part: Curtis p/n 17519022.

Wiring Diagram

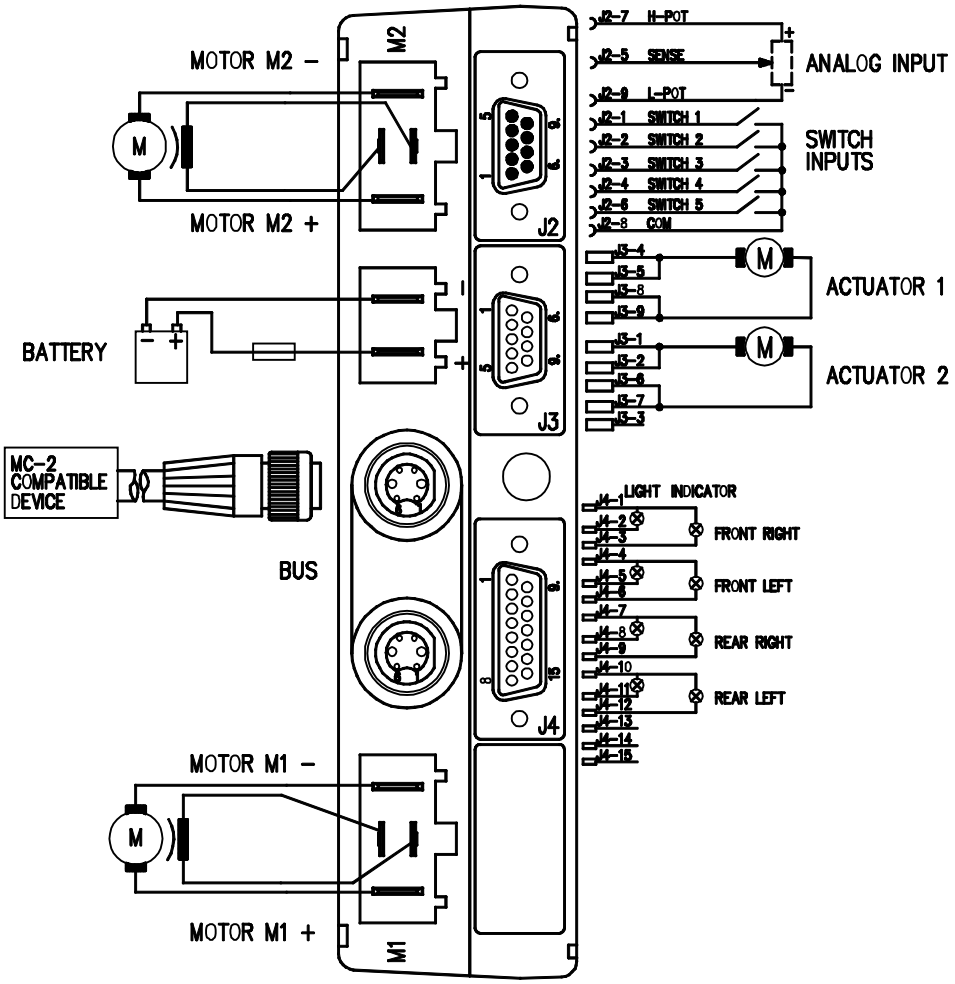


Fig. 7: *Standard wiring configuration for the MC-2 1705-X014 Controller with Actuators and Light*

Specifications

MC-2 1705-X01X Controller

Table 3: *Specifications for all Controllers*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximal voltage (no damage of the devices)	35 V
Standby current	6 mA
PWM frequency	18 kHz
Nominal park brake voltage	24 V
Maximal park brake current	1 Amp
Current rating Controller **1705-201X**	
15 seconds	100 Amps
1 minutes	70 Amps
1 hour	35 Amps
Controller **1705-301X**	
15 seconds	60 Amps
1 minutes	50 Amps
1 hour	30 Amps
Operating ambient temperature range	-25°C to 50°C
Heatsink overtemperature cutback	80°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90 % RH
Weight Controller **1705-X010**	1.36 kg
Controller with Actuators **1705-X013**	1.44 kg
Controller with A/L **1705-X014**	1.44 kg
Case material	aluminium
Case finish	Epoxy powder coat
Case sealing	IP54

MC-2 1705-X013 Controller with Actuator

Table 4: *Actuator Current rating for 1705-X013*

Combination	High current actuator output 1	High current actuator output 2	Low current actuator output 3	Low current actuator output 4	Current output for 10 sec. per actuator in amps	Continuous output per actuator in amps
1	x				20	10
2		x			20	10
3			x		8	4
4				x	8	4
5	x	x			12	6
6			x	x	8	4
7	x			x	16 / 8	8 / 4
8		x	x		16 / 8	8 / 4
9	x		x		Not a possible combination	
10		x		x	Not a possible combination	

MC-2 1705-X014 Controller with Actuators and Light

Table 5: *Actuator specifications for 1705-X014*

Combination	Actuator output 1	Actuator output 2	Total current output for 1 minute	Total continuous current output
1	X		10A	6A
2		X	10A	6A
3*	X	X	12A	8A

* In this configuration both actuators can only be moved in the same direction with the same speed

Table 6: *Light specifications for 1705-X014*

Voltage (Stabilized)	6…11V	12…19 V	20…24 V
Driving light front power	2x 10 W	2x 15 W	2x 21 W
Driving light rear power	2x 5 W	2x 10 W	2x 10 W
Indicator light left power	2x 10 W	2x 15 W	2x 21 W
Indicator light right power	2x 10 W	2x 15 W	2x 21 W

Configuration for Actuators

A first-time configuration is necessary before using the Actuators of the 'Controller with Actuators' and the 'Controller with Actuators and Light'. A distinction is to be made between an MC-2 System with Hand Control and an MC-2 System with LCD. The System with Hand Control allows assignment of a maximum of four AUX channels. With the LCD up to eight assignments are possible.

Controller and Hand Control Configuration

At least the following modules must be connected: Controller *, Hand Control, and PC Programming Station.

* Controller with Actuators or Controller with Actuators and Light

Note: This configuration can only be performed with the PC Programming Station.

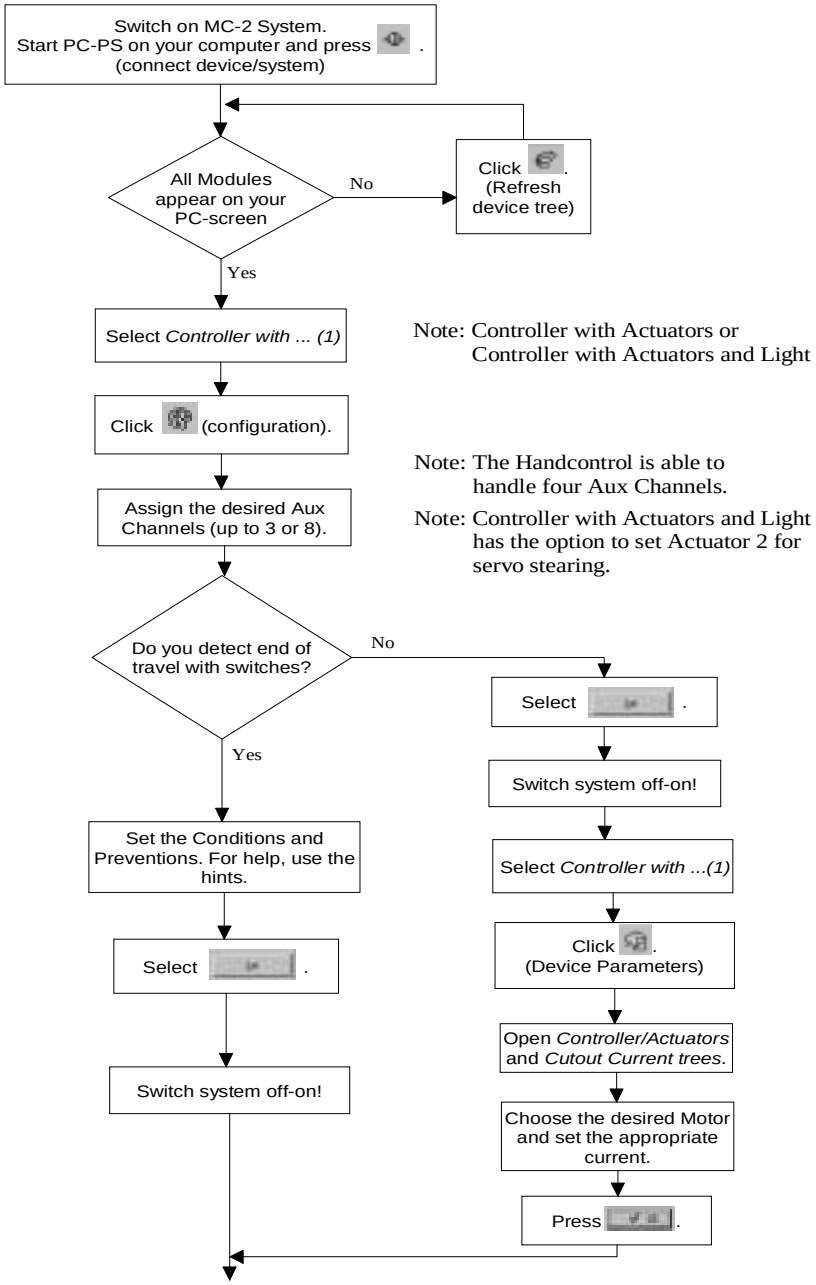
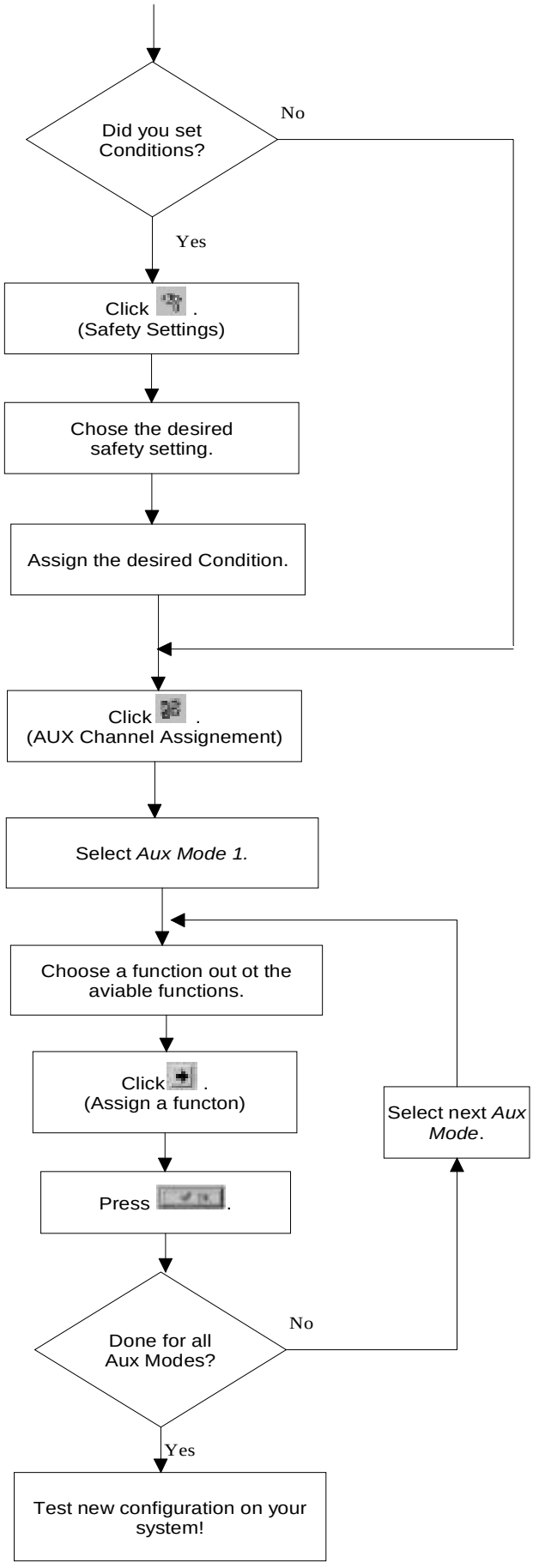


Fig. 8: *Configuration for 'Controller with Actuators' or 'Controller with Actuators and Light' and Hand Control, part 1/2*

Fig. 9: *Configuration for 'Controller with Actuators' or 'Controller with Actuators and Light' and Hand Control, part 2/2*



Controller and LCD Configuration

At least the following modules must be connected: Controller *, LCD, Hand Control or Specialty Input Device with MFS and PC Programming Station.

* Controller with Actuators or Controller with Actuators and Light

Note: This configuration can only be performed with the PC Programming Station.

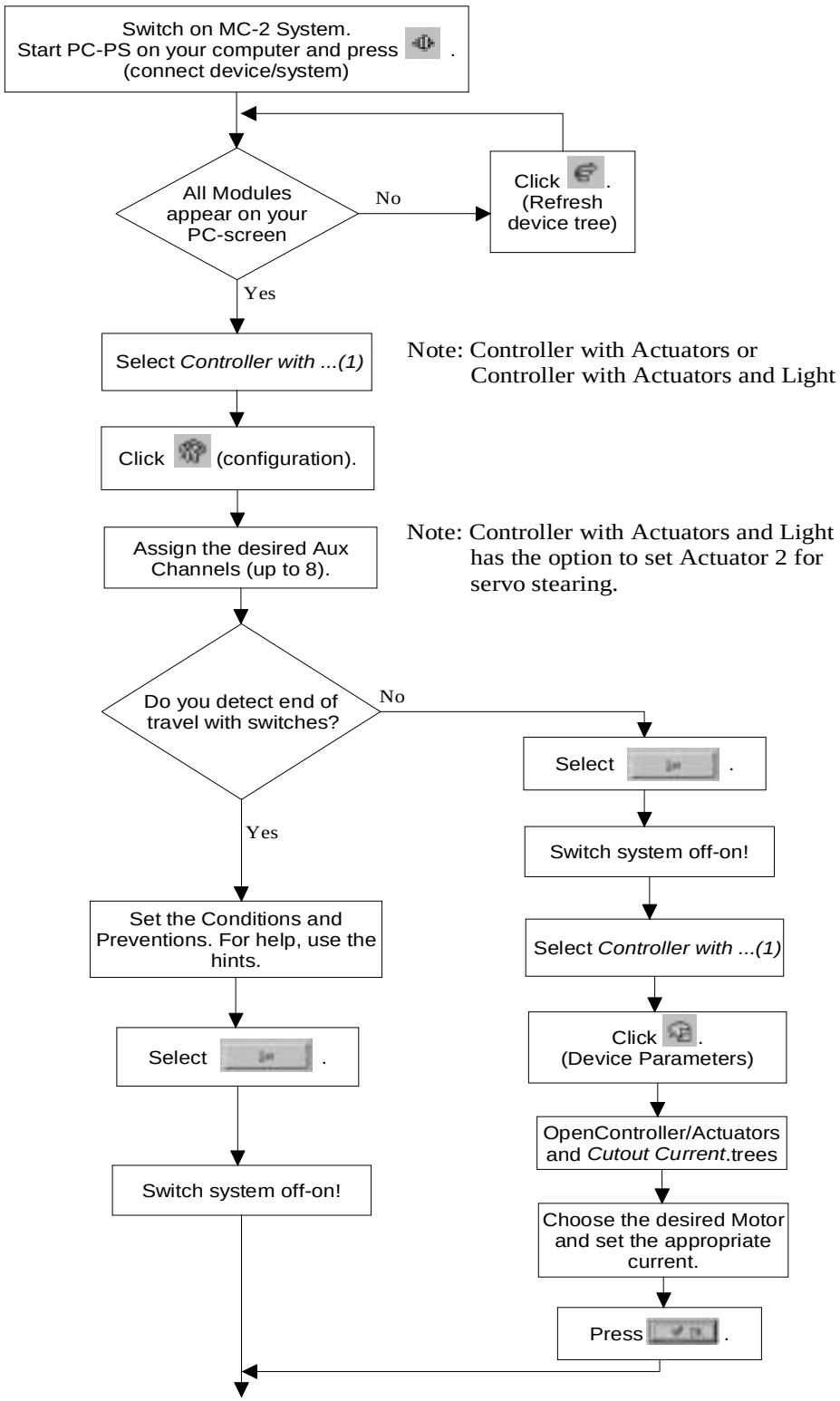


Fig. 10: *Configuration for 'Controller with Actuators' or 'Controller with Actuators and Light' and LCD, part 1/2*

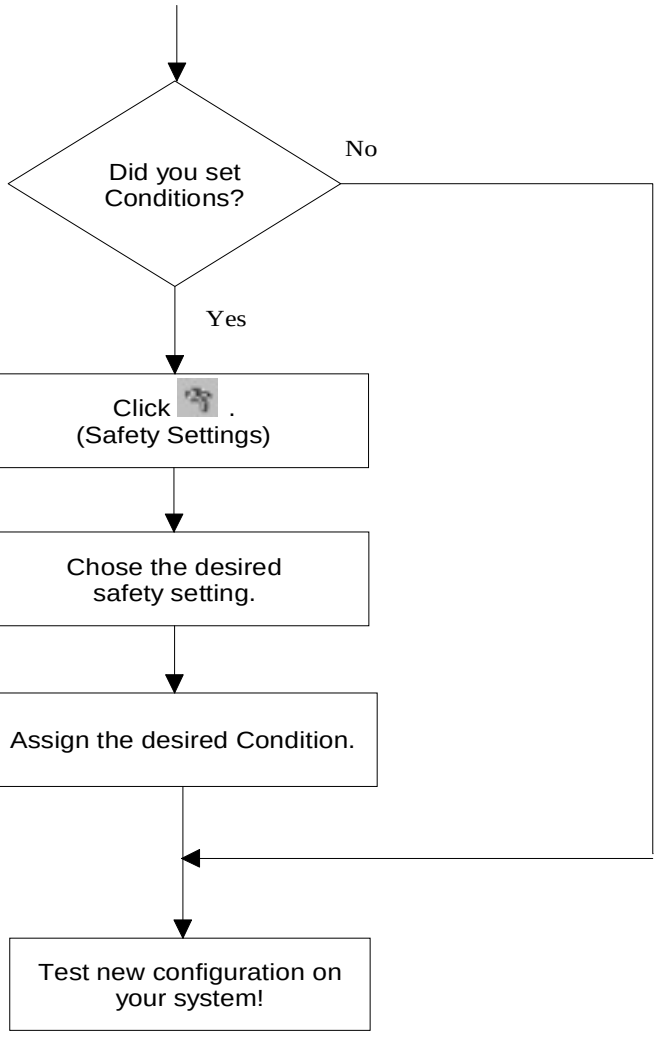


Fig. 11: *Configuration for 'Controller with Actuators' or 'Controller with Actuators and Light' and Hand Control, part 2/2*

3 1720-501X HAND CONTROL

Overview

The CURTIS 1720-501X Hand Control provides easy handling and full comfort with its ergonomic Joystick. Four drive modes and four auxiliary modes complete this advanced input device of the modular CURTIS MC-2 system.

Fig. 12: *MC-2 1720-5010 Hand Control and 1720-5012 Hand Control with Light*

These Hand Controls are the standard input devices for the MC-2 System. They provide easy and full controllability of power wheelchair applications.

Variations

There are three different Hand Controls available:

- 1720-5010 Hand Control is ideal for the 1705-2010 Controller and the 1705-X013 Controller with Actuator.
- 1720-5012 Hand Control with Light is made specifically for the 1705-X012 Controller with Light. It provides buttons for all driving lights and indicators in addition to all other functions.
- 1720-5011 Attendant Control has only one working Drive Mode. Otherwise, the functions and the case are the same as those of the 1720-5010 Hand Control.

Features

- ✓ One model can be easily programmed to meet many specific power wheelchair applications.
- ✓ Four separate driving modes for optimum driving. Customized for different conditions, such as indoor, outdoor or sport.
- ✓ Four separate auxiliary modes for special functions like seat motors, environmental control, etc.
- ✓ Battery state of charge and error codes are continuously displayed in front of the Joystick.
- ✓ Up to 20 programmable drive presets.
- ✓ Compact and attractive design.
- ✓ Advanced keypad buttons provide positive tactile feedback to the user to ensure that the button has been properly depressed.
- ✓ The progressive, changeable Joystick knob is made of soft material to maximize control and comfort, and is designed to accommodate a variety of gripping options.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Meets US and European Standards. The Hand Control is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.
- ✓ Fully compatible with the Handheld Programmer for testing, diagnostics, and parameter adjustments.
- ✓ Advanced capability with PC Programming Station.
- ✓ Software update by OEM through any connector.
- ✓ Model 1720-5011 provides only one driving mode, but has all the functions of model 1720-5010.
- ✓ Model 1720-5012 provides buttons for driving lights, indicators, and hazard lights.

Installation

Installing the Hand Control

The overall dimensions and mounting thread dimensions for the 1720-501X Hand Control are shown in the figure below.

The Hand Control can be oriented in any position for maximum user comfort. The direction of the Joystick is set by the 'Assign Direction' function, depending on the mounting position.

Make sure the LCD Screen is installed for optimum viewing.

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Dimensions

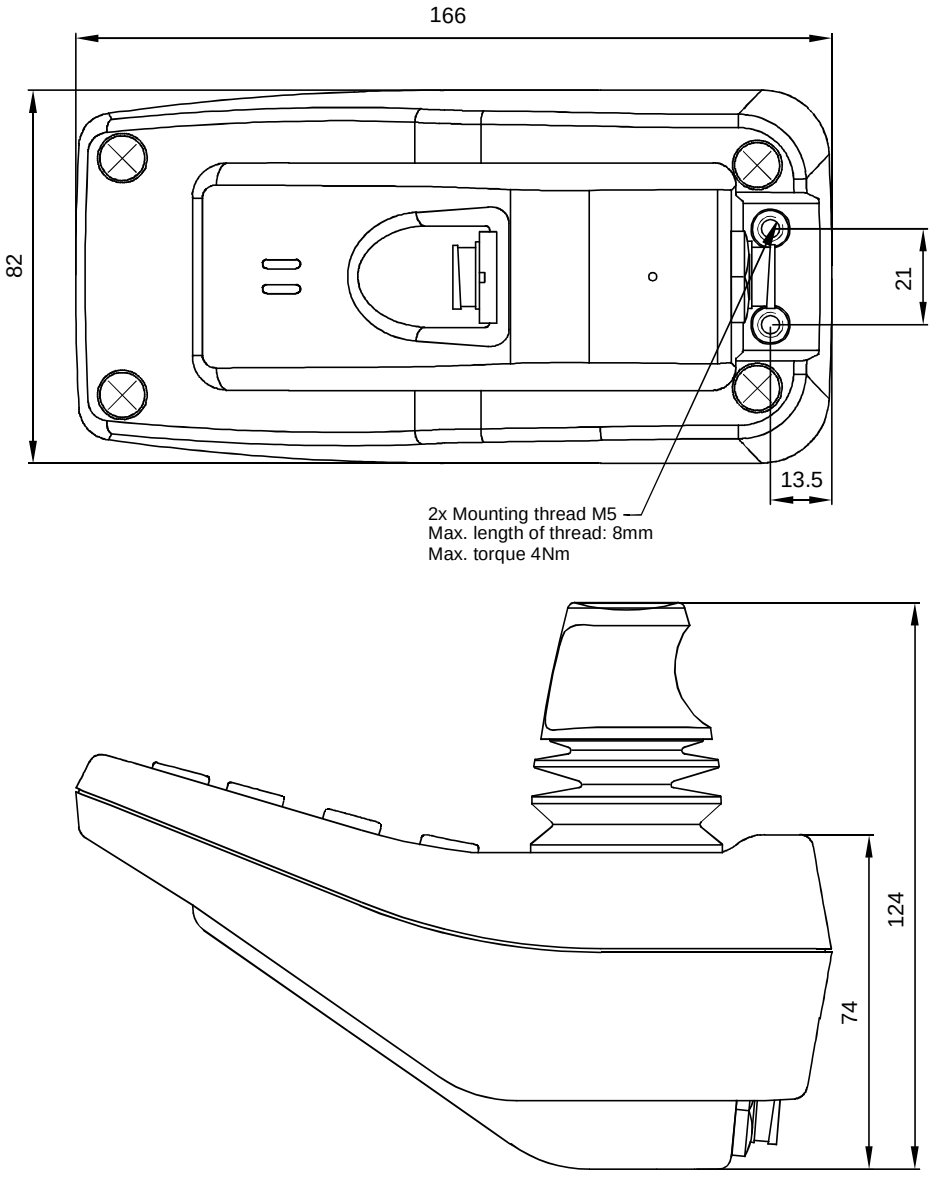


Fig. 13: *Mounting dimensions, Curtis MC-2 1720-501X Hand Control*

Specifications

Table 7: *For all Hand Controls*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximal voltage (no damage to the devices)	35 V
Standby current	5 mA
Operating current typical	108 mA
Horn frequency	1.3 kHz
Acoustical feedback frequency	3.0 kHz
Joystick operating force	1.5 N nominal
Operating ambient temperature range	-25°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90 % RH
Weight	0.36 kg
Case material	PC/ABS
Case sealing	IP54

Operating Instructions

1720-5010 Hand Control or 1720-5011 Attendant Control

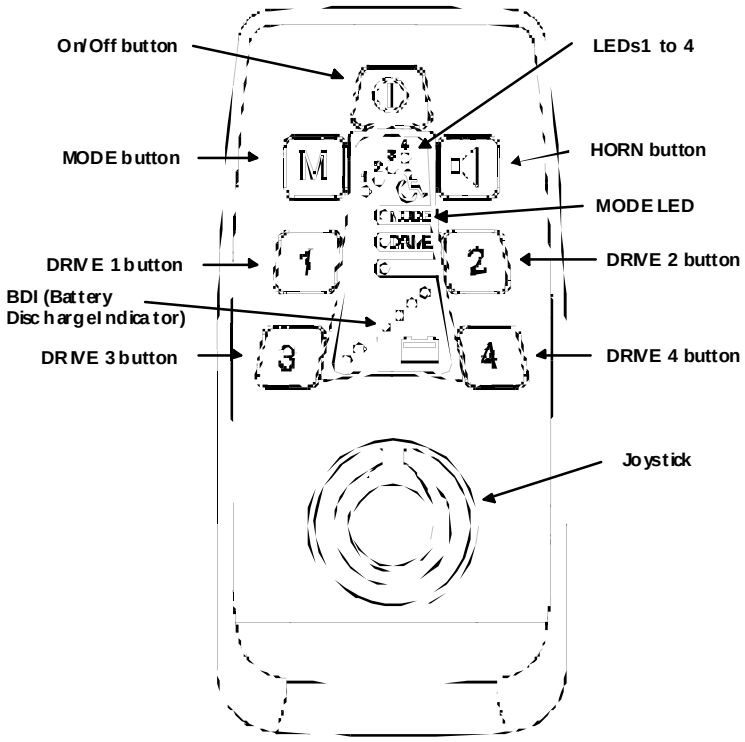


Fig. 14: *Functionality of the 1720-5010 Hand Control*

To turn power **ON**, press *On/Off* button.

Select Drive 1 to 4 (applies to Hand Control only)

When power is ON, the system is in DRIVE 1. Pressing any *DRIVE* button changes the system to the selected drive. LEDs 1 to 4 indicate the selected DRIVE.

Select Auxiliary Function (e.g., seat motors)

This function is available only if an Output Module, such as the Seat Module, ECU Module, or Controller with actuators, is installed and appropriately set.

Pressing the *MODE* button changes the system to AUX 1. This is indicated by the MODE LED. Briefly depressing the *MODE* button advances the system to the next AUX channel. LEDs 1 to 4 indicate the selected AUX. From AUX 4, pressing the *MODE* button again changes the selection to AUX 1.

To return to Drive, press the desired *DRIVE* button.

To turn power **OFF**, press *On/Off* button.

The **BDI** (Battery Discharge Indicator) continuously indicates the battery discharge level using a set of seven LEDs. It provides useful, actual battery capacity information. Full battery capacity is indicated when all seven LEDs are on.

1720-5012 Hand Control with Light

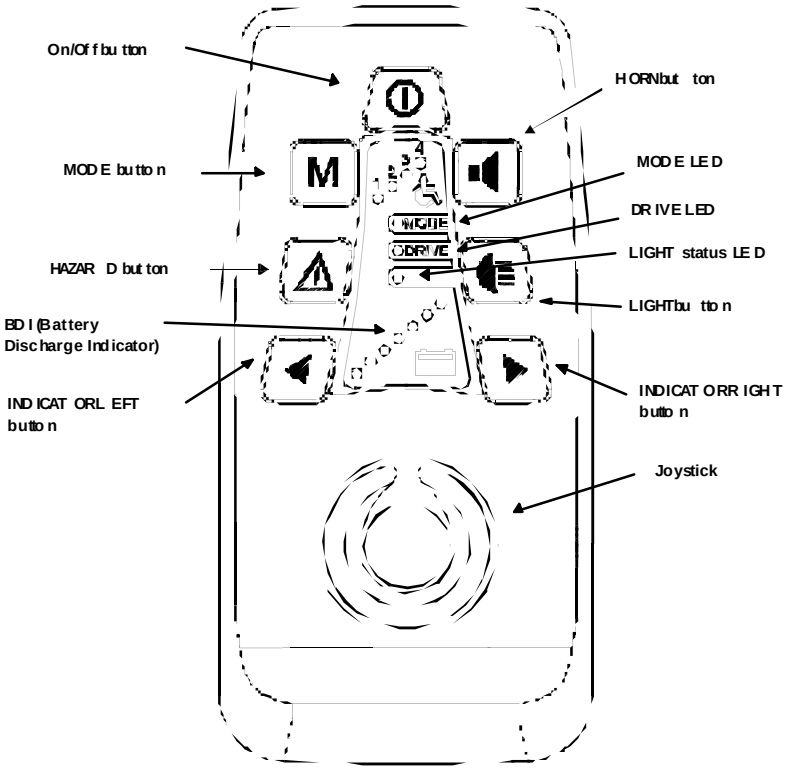


Fig. 15: *Functionality of the 1720-5012 Hand Control with Light*

To turn power **ON**, press *On/Off* button.

Select Drive 1 to 4

When power is ON, the system defaults to DRIVE 1 and the DRIVE LED is illuminated. Briefly depressing the *MODE* button advances the system sequentially to the next drive channel as indicated by LEDs 1 to 4.

Select Auxiliary Function (e.g., seat motors)

This function is available only if an Output Module, such as the Seat Module, ECU Module, or Controller with actuators, is installed and appropriately set.

If the system is in the Drive mode (DRIVE LED is on): Depress the *MODE* button until the MODE LED goes on. Briefly depressing the *MODE* button advances the system sequentially to the next AUX channel as indicated by LEDs 1 to 4.

To return to the Drive mode, repeatedly depress the *MODE* button until the DRIVE LED goes on.

Lighting Control (a Controller with Light must be installed)

Depress the desired push button to turn on the lights, the left or right indicator, or the hazard lights. The LIGHT status LED goes on when the lights are on or blinks when the left or right indicator or the hazard light is actuated.

A second push of the button will turn off the originally selected lights, the left/right indicators, or the hazard lights. The LIGHT status LED will go off.

To turn power **OFF**, press the *On/Off* button.

Hand Control with LCD Display

This section describes the additional commands for using an LCD Display.

Table 8: *List of Commands*

Command	Input Assigned
Previous	Joystick forward > 50%
Next	Joystick reverse > 50%
Select	Joystick right > 50%
ESC	Joystick left > 50%

Calibrate

Re-calibrating is recommended when you feel the wheelchair movement is not proportional to the Joystick deflection, the maximum speed cannot be reached, or if you had to change the setting of the Joystick.

To execute 'Calibrate,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Hand Control/Calibrate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Hand Control and choose *Calibrate*. The screen will guide you through the process.

Assign Direction

Depending on the handicap of the user, the Hand Control might be mounted in a direction different from the wheelchair's longitudinal axis (e.g., in a 90 degree angle).

Even in such cases, a forward movement of the Joystick must be generating a forward command. To achieve this, a new direction assignment is necessary.

To execute 'Assign Direction,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Hand Control/Assign Direction*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Hand Control and choose *Assign Direction*. The screen will guide you through the process.

Evaluation Mode

The evaluation mode is a very helpful function for the user to practice the commands used to operate the power wheelchair.

In the evaluation mode the user is prompted to imitate a randomly generated command. At the end of the pre-selected time of the 'game,' the user receives a summary of the total number of commands and the total number of score points.

To execute 'Evaluate,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Hand Control/Evaluate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Hand Control and choose *Evaluate*. The screen will guide you through the process.

4 1712-6010 LCD DISPLAY

Overview

The CURTIS 1712-6010 LCD Display is used in conjunction with specialty input devices of the modular MC-2 system, such as the Sip & Puff, Stand Alone Joystick, Headcontrol, and Tash.

It provides input for remote switches, Tash, and the MFS (Multi-Function Switch).

Fig. 16: *1712-6010 LCD Display*

However, the system with standard Hand Control can also be equipped with the LCD Display. This will enable the user to operate an almost unlimited number of auxiliary devices as well as to change user-level parameters.

Features

- ✓ Large and easy-to-read Graphic Display.
- ✓ Back-lighted for independence from any light source.
- ✓ Displays clear and simple diagnostic information.
- ✓ Easy menu handling through display information.
- ✓ Tash-compatible Input (9 pin D-connector).
- ✓ Supports 1-, 2-, 3-, and 5-switch Tash.
- ✓ Remote Switch Input programmable.
- ✓ Integrated horn.
- ✓ Easily and fully programmable using the Curtis Handheld Programmer or PC Programming Station.
- ✓ Software update by OEM through any connector.
- ✓ Customized screens and languages possible.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Meets US and European Standards. The LCD Display is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.

Installation and Wiring

Installing the LCD Display

The overall dimensions and mounting hole dimensions for the 1712-6010 LCD Display are shown in the figure below.

The LCD Display can be oriented in any position for maximum user comfort. Install the LCD screen for optimum viewing.

Dimensions

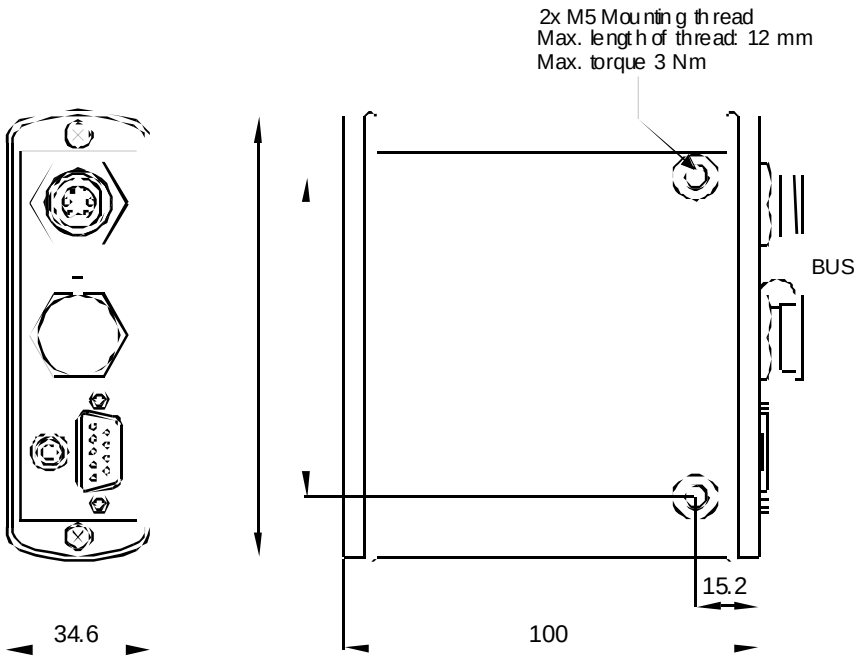


Fig. 17: *Mounting dimensions, 1712-6010 LCD Display*

Wiring the 1712-6010 LCD Display

When using a Hand Control, simply connect the 1712-6010 to the bus. Do not switch off the system (hot plug). The LCD Display will assume the display function and the Hand Control display goes off. To disconnect the LCD Display, switch the system off and on. Otherwise the Hand Control will not assume the display function.

When using a specialty input (Stand Alone Joystick, Headcontrol, Sip & Puff, Tash), an MFS (Multi-Function Switch) must also be connected.

Optionally, remote switches can be connected to the 9-pin D-sub connector. The possible functions of the remote switches can be seen in the figure below.

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Low-Current Connection

The D-Sub connectors provide input for the Tash or the remote switches. The mating connector for the switch input is a 9-pin D-Sub with socket contacts.

The 3.5 mm stereo plug provides input for the MFS.

Wiring Diagram

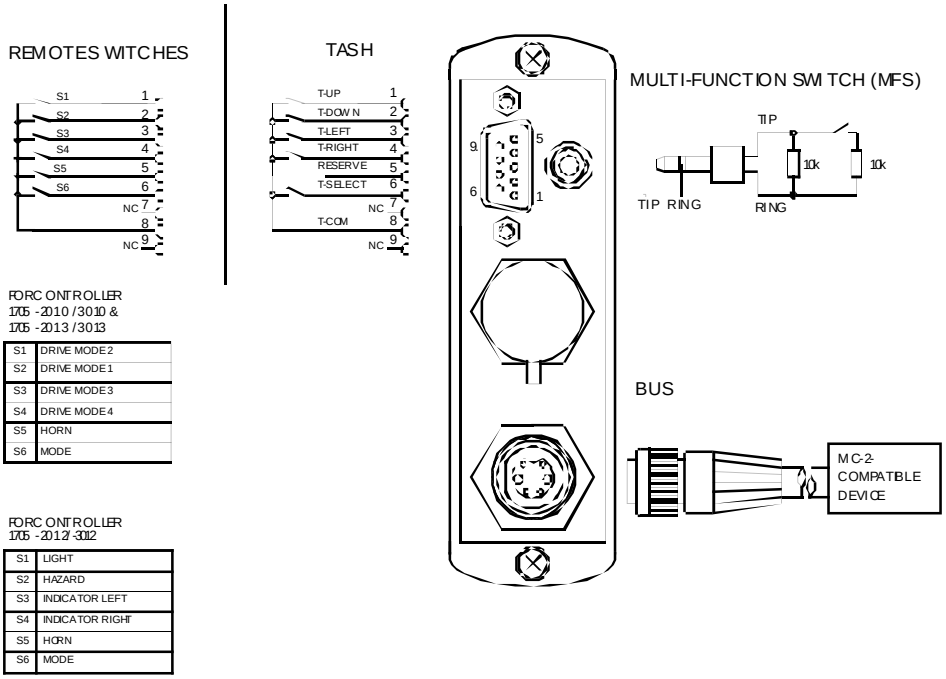


Fig. 18: *Wiring configuration, 1712-6010 LCD Display*

Specifications

Table 9: *Specifications for LCD Display*

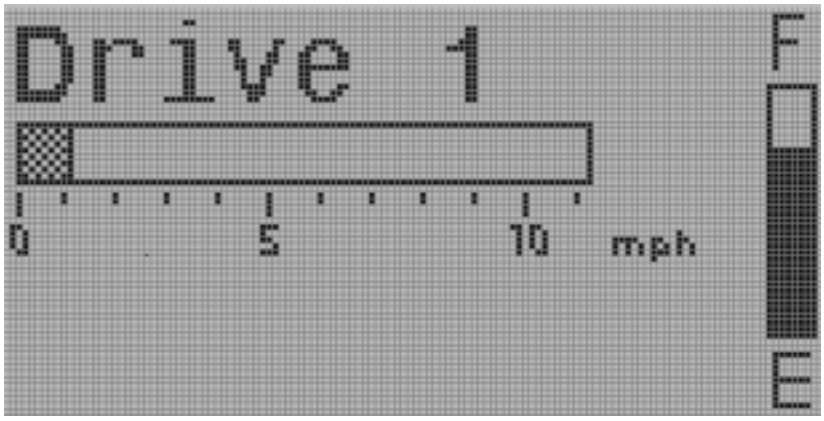
Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximum voltage (no damage to the devices)	35 V
Standby current	9 mA
Operating current typical	84 mA
Horn frequency (adjustable)	600 - 3100 Hz
Acoustic feedback (adjustable)	600 - 3100 Hz
Operating ambient temperature range	-10°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90% RH
Graphic display (with backlight)	128 x 64 dots
Weight	0.30 kg
Case material	aluminum
Case sealing	IP54

Explanation of the Screen Elements

Drive Screen

If the MC-2 system is equipped with a Hand Control, the LCD shows the Drive screen as the default screen after the system has been switched on. The Drive screen with the specialty input devices is reached after having selected the 'Drive modes / Drive X' LCD menu.

Fig. 19: *Drive Screen LCD Display*



The Drive Screen shows the following:

- The number of the selected drive
- A bar representing the BDI
- A bar showing the actual speed

Menu Screen

If the MC-2 system is equipped with a specialty input device, the LCD shows the Menu Screen as a default screen after the system has been switched on. The Menu Screen with a Hand Control can be reached by pressing the Mode key.

A Menu Screen shows a maximum of 5 lines (menu entries) at a time.

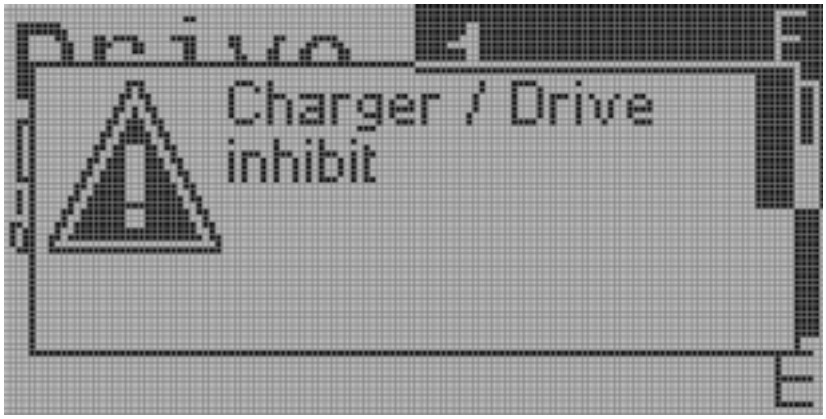
The Menu Screen below shows on the left a double line indicating the actual menu level (2 in this example). On the right there is the cursor for 1-switch Tash operation (currently shows readiness for a SELECT command).

Fig. 20: *Menu Screen LCD Display*

Fault Screens

Each fault that may occur is displayed as a new window on the currently displayed screen.

Fig. 21: *Fault Screen LCD Display*



Pictograms

Table 10: *Pictogram of LCD Display*

Pictogram	**Signification**
←	Indicator left
→	Indicator right
⚠ ← →	Hazard
	Light indicator
	Scanner (used with 1-switch Tash). Turns counterclockwise around the screen in the following order: TOP, LEFT, CENTER, BOTTOM, RIGHT
▲	Forward direction (used with Head Control or 3-switch Tash)
▼	Reverse direction (used with Head Control or 3-switch Tash)
‖	The number of bars shows the current menu level, i.e., the depth of the currently selected menu item.

Operating Instructions (with Tash and Remote Switches only)

Note that an **MFS** (Multi-Function Switch) is necessary to operate the MC-2 system with all Tash switch devices.

Commands Common to all Tash-Switches

Table 11: *MFS commands*

Command	Input assigned
On	MFS long
Off	MFS long
Esc	MFS short (if not otherwise stated)

Commands for the 1-Switch Tash

To be able to handle the menus with only one switch, the 4- or 8-Way Scan mode is available. The number of indicators (4 or 8) and the scan rate are adjustable.

Table 12: *4-Way Scan*

Command	Input assigned
Forward	 If background screen is a Drive mode.
Reverse	 If background screen is a Drive mode.
Right	 If background screen is a Drive mode.
Left	 If background screen is a Drive mode.
Previous	
Next	
Select	
Esc	
Mode	
T	After programmable timeout, screen goes up one level.

In the 8-Way Scan mode, the following additional four diagonal driving directions are available:

Fig. 22: *8-Way Scan*

These additional scan figures are only applicable for the Drive modes. For menu handling, only the figures of the 4-Way Scan have an associated action.

Mode or ESC command in the top menu disables scanning (direction and center indicators OFF).

Commands for the 2-Switch Tash

Switch A: for “Forward,” “Previous,” and “Select” commands

Switch B: for “Reverse,” “Next,” and “ESC” commands

Table 13: *2-Switch commands*

Command	Input assigned
Forward	Switch A, short command followed by a long (continuous) command
Reverse	Switch B, short command followed by a long (continuous) command
Right	Switch A
Left	Switch B
Previous	Switch A, 2x short
Next	Switch B, 2x short
Select	Switch A short
ESC	Switch B short
ESC	MFS short
T	After programmable timeout, screen goes up one level.

Commands for the 3-Switch Tash

The three switches are: ← switch, → switch, and switch C

Switch C: for “Forward,” “Reverse,” “Previous,” and “Next” commands

- The default direction is always forward
- There are two ways to toggle between “Forward” and “Reverse” commands:
  - A brief activation of switch C
  - MFS short (if Parameter *MFS Double Command* is set)

If MFS short is programmed to toggle between “Forward” and “Reverse” (Parameter *MFS Double Command* is set), the ESC command is only possible with two MFS shorts.

Table 14: *3-Switch commands*

Command	Input assigned
Forward	Switch C, if ▲ indicator is shown
Reverse	Switch B, if ▼ indicator is shown
Right	→ Switch
Left	← Switch
Previous	Switch C, if ▲ indicator is shown
Next	Switch C, if ▼ indicator is shown
Select	→ Switch
ESC	← Switch
ESC	MFS short or MFS 2x short
T	After programmable timeout, screen goes up one level.

Commands for the 5-Switch Tash (Wafer Board)

The 5th switch on the wafer board will be used in the same way as the MFS short command.

Table 15: *5-Switch commands*

Command	Input assigned
Forward	∧ switch (can be combined with → switch or ← switch)
Reverse	∨ switch (can be combined with → switch or ← switch)
Right	→ switch
Left	← switch
Previous	∧ switch
Next	∨ switch
Select	→ switch
ESC	← switch
ESC	MFS short or 5th switch
T	After programmable timeout, screen goes up one level

Commands for Remote Switches

There are two types of Remote Switches possible, depending on the attached controller in the system. The controller does the differentiation automatically.

The Remote Switches are an image of the Hand Control buttons.

Table 16: *Remote Switches for 1705-X010 Controller and 1705-X013 Controller with Actuator*

Command	Switch assigned
Drive Mode 1	Switch 1
Drive Mode 2	Switch 2
Drive Mode 3	Switch 3
Drive Mode 4	Switch 4
Horn	Switch 5
Mode	Switch 6

Table 17: *Remote Switches for 1705-X012 Controller with Light*

Command	**Switch assigned**
Light	Switch 1
Hazard	Switch 2
Indicator Left	Switch 3
Indicator Right	Switch 4
Horn	Switch 5
Mode	Switch 6

Driving and Using the AUX Function

Switching on the system with the MFS long command brings up the menu. Navigating through the menu using the above commands causes the desired command to be issued (Drive or AUX function). An emergency stop can be achieved by issuing an MFS long command.

Configuration for Tash and Remote Switches

A first-time configuration is necessary before using the Tash or Remote switches.

1- to 5-Switch Tash Configuration

At least the following modules must be connected: Controller, LCD with Tash Product and MFS, and PC Programming Station.

Note: This configuration can also be done with the Handheld Programmer

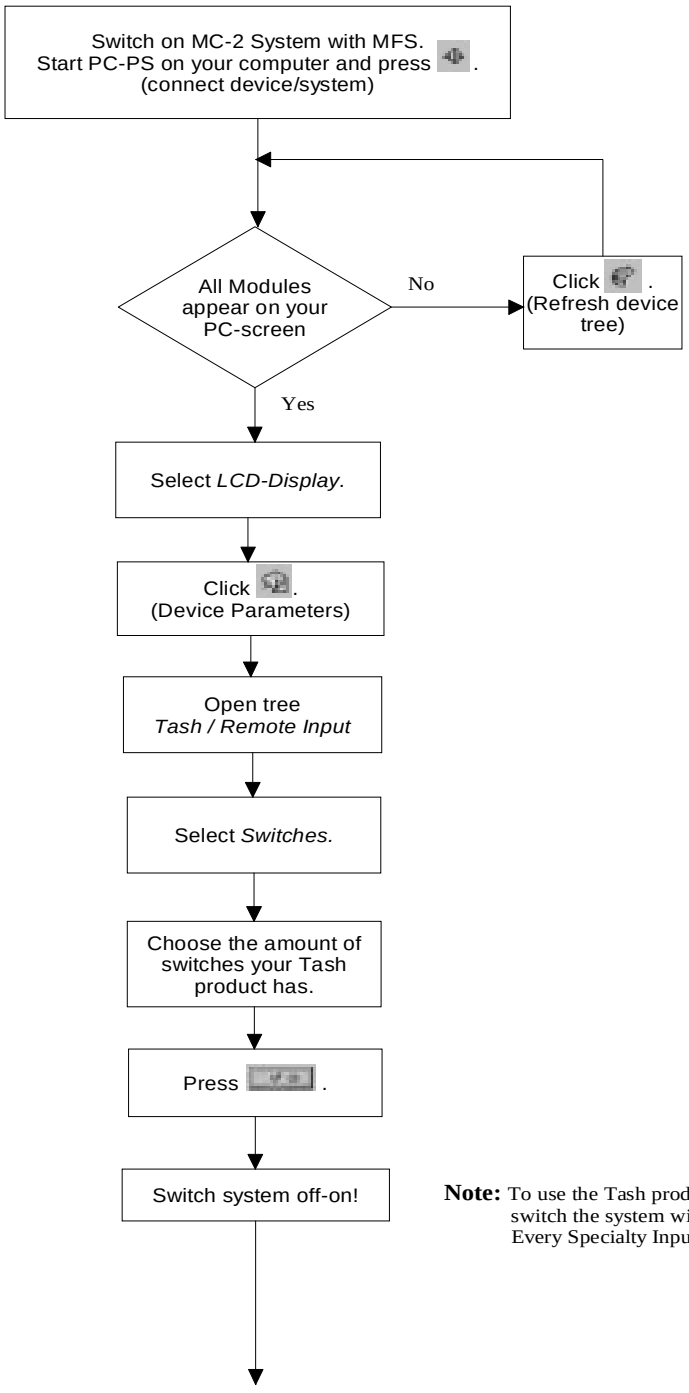
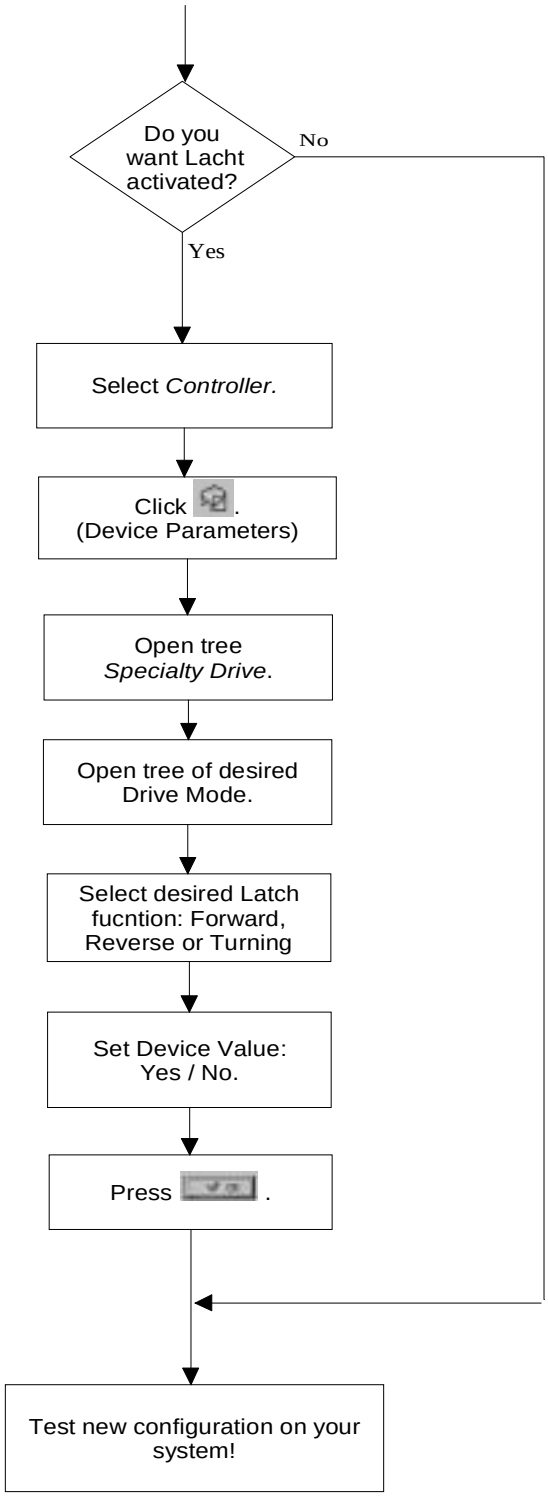


Fig. 23: *Configuration for 1- to 5-Switch Tash, part 1/2*

Note: To use the Tash product, you have to switch the system with the MFS on. Every Specialty Input needs an MFS.

Fig. 24: *Configuration for 1- to 5-Switch Tash, part 2/2*

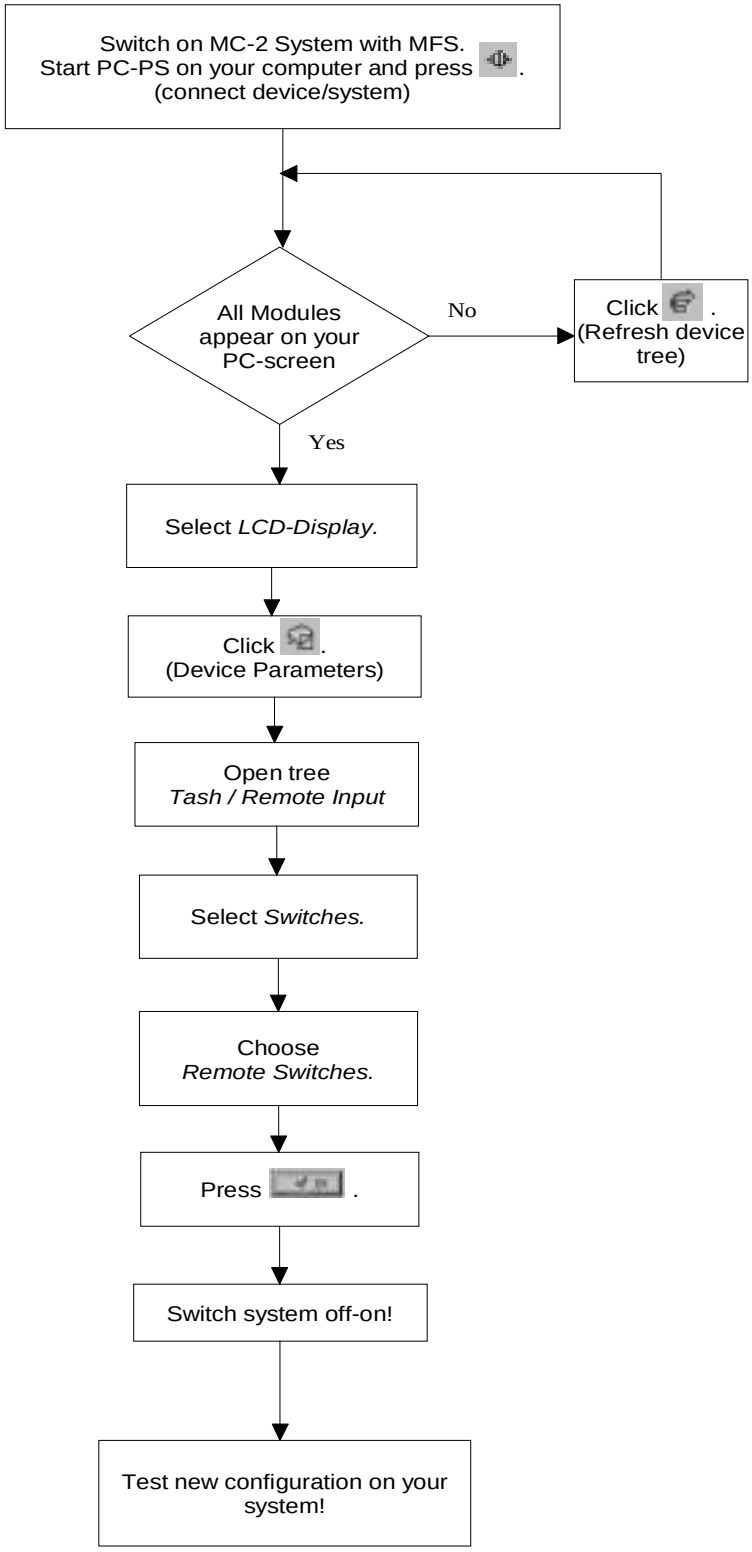


Remote Switch Configuration

At least the following modules must be connected: Controller, LCD with Remote Switches, and PC Programming Station.

Note: This configuration can also be performed using the Handheld Programmer

Fig. 25: *Configuration for Remote Switches*



5 1710-5010 STAND ALONE JOYSTICK

Overview

The Stand Alone Joystick is a Specialty Input device of the modular CURTIS MC-2 system. It is used for driving and navigating in the LCD Display menu for auxiliary functions, parameter setting, and information.

It provides maximum comfort with its ergonomic Joystick and a variety of mounting positions protected by a small and rugged case.

Fig. 26: *1710-5010 Stand Alone Joystick*

Since the Stand Alone Joystick is a Specialty Input device, an LCD with an MFS is mandatory.

Features

- ✓ Four separate driving modes for optimum driving. Customized for different conditions such as indoor, outdoor, or sport.
- ✓ Separate auxiliary modes for special functions like seat motors, environmental control, etc.
- ✓ LCD Display provides comfortable drive feedback and menu handling.
- ✓ Up to 20 programmable drive presets.
- ✓ Compact and attractive design.
- ✓ A variety of joystick templates allows optimum adjustment for the user.
- ✓ The progressive, changeable Joystick knob is made of soft material to maximize control and comfort; it is designed to accommodate a variety of gripping options.
- ✓ The small and rugged case offers alternative mounting positions.
- ✓ 'Assign Direction' function provides full mounting freedom.
- ✓ One model can be easily programmed to meet many specific power wheelchair applications.
- ✓ Fully compatible with the Curtis Handheld Programmer and the PC Programming Station for testing, diagnostics, and parameter adjustments.
- ✓ No software update possible.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Meets US and European Standards. The Stand Alone Joystick is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.

Installation

Installing the Stand Alone Joystick

The overall dimensions and mounting thread dimensions for the 1710-5010 Stand Alone Joystick are shown in the figure below.

The Stand Alone Joystick can be oriented in any position for maximum user comfort. The direction of the Joystick is set by the 'Assign Direction' function, depending on the mounting position.

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Dimensions

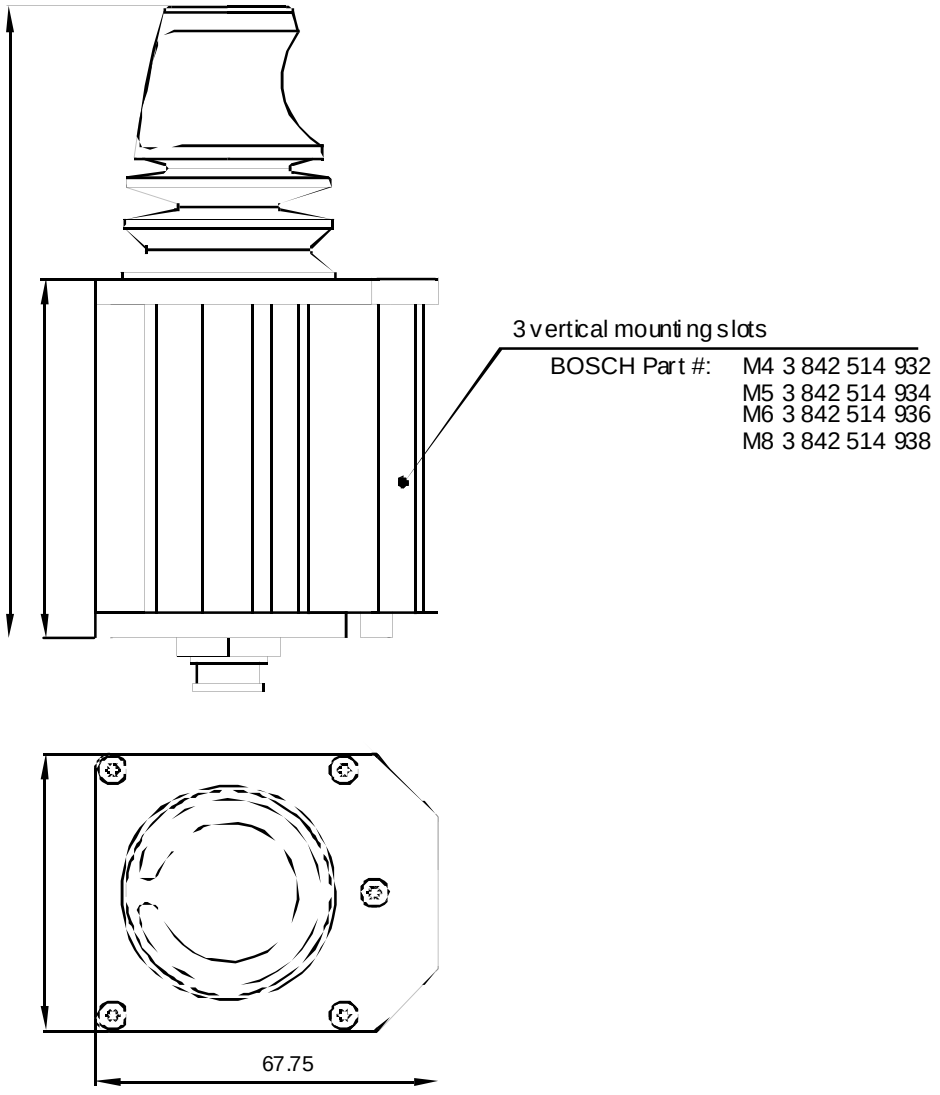


Fig. 27: *Mounting dimensions, 1710-5010 Stand Alone Joystick*

Specifications

Table 18: *Specifications for Stand Alone Joystick*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximum voltage (no damage to the devices)	35 V
Standby current	4 mA
Operating current, typical	41 mA
Joystick operating force	1.5 N nominal
Operating ambient temperature range	-25°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90% RH
Weight	0.34 kg
Case material	aluminum
Case sealing	IP54

Operating Instructions

Note that an **MFS** (Multi-Function Switch) and an LCD Display are necessary to operate the MC-2 system.

Commands

Table 19: *Commands for Stand Alone Joystick*

Command	**Input assigned**
On	MFS long
Off	MFS long or ON/OFF button if Hand Control is in system
Previous	Joystick forward > 50%
Next	Joystick reverse > 50%
Select	Joystick right >50%
ESC	Joystick left > 50%
ESC	MFS short
T	After programmable timeout, screen goes up one level

Assign Direction

The Stand Alone Joystick can be oriented in any position for maximum user comfort. However, forward movement of the Joystick must generate a forward command. To achieve this a new direction assignment is necessary.

To execute ‘Assign Direction,’ connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Stand Alone Joystick/Assign Direction*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Stand Alone Joystick and choose *Assign Direction*. The screen will guide you through the process.

Calibrate

Recalibrating is recommended when you feel the wheelchair movement is not proportional to the joystick deflection, the maximum speed cannot be reached, or you had to change the settings of the Joystick.

To execute 'Calibrate,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Stand Alone Joystick/Calibrate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Stand Alone Joystick and choose *Calibrate*. The screen will guide you through the process.

Evaluation Mode

The evaluation mode is a helpful function for the user to practice the commands used to operate the power wheelchair.

In the evaluation mode, the user is prompted to imitate a randomly generated command. At the end of the pre-selected time of the 'game,' the user receives a summary of the total number of commands and the total number of score points.

To execute 'Evaluate,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Stand Alone Joystick/Evaluate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Stand Alone Joystick and choose *Evaluate*. The screen will guide you through the process.

Driving and Using the AUX Function

Switching on the system with the MFS long command brings up the menu. Selecting from the menu one of the commands listed above causes the desired command (Drive or AUX function) to be issued. An emergency stop can be achieved by an MFS long command.

6 1713-5010 HEADCONTROL

Overview

The 1713-5010 Headcontrol is a Specialty Input device of the modular CURTIS MC-2 system. It is used for driving and navigating in the menu of the LCD Display for auxiliary functions, parameter setting, and information.

A variety of mounting positions are available for maximum comfort.

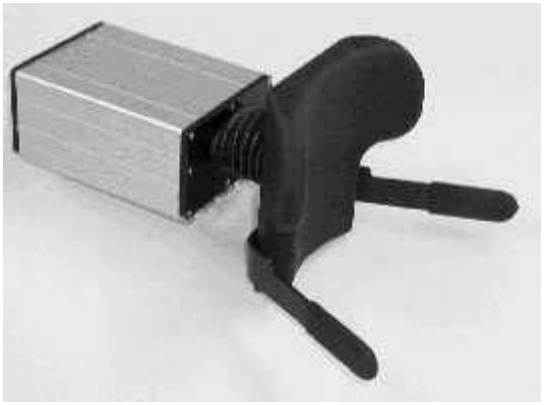


Fig. 28: *1713-5010 Headcontrol with a Head Rest as an example*

Since the Headcontrol is a Specialty Input device, an LCD with an MFS is mandatory.

Features

- ✓ Four separate driving modes for optimum driving. Customized for different conditions such as indoor, outdoor, or sport.
- ✓ Separate auxiliary modes for special functions like seat motors, environmental control, etc.
- ✓ The LCD Display provides comfortable drive feedback and menu handling.
- ✓ Up to 20 programmable drive presets.
- ✓ Compact and attractive design.
- ✓ Adapter for mounting any headrest.
- ✓ Rugged case offers alternative mounting positions.
- ✓ Direction Assignment possible.
- ✓ One model may be easily programmed to meet many specific power wheelchair applications.
- ✓ Fully compatible with the Curtis Handheld Programmer and the PC Programming Station for testing, diagnostics, and parameter adjustments.
- ✓ No software update possible.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Meets US and European Standards. The Headcontrol is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.

Installation

Installing the Headcontrol

The overall dimensions and mounting dimensions for the 1713-5010 Headcontrol are shown in the figure below.

The Headcontrol can be oriented in any position for maximum user comfort. ‘Assign Direction’ function allows assignment of direction, depending on the mounting position.

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Dimensions

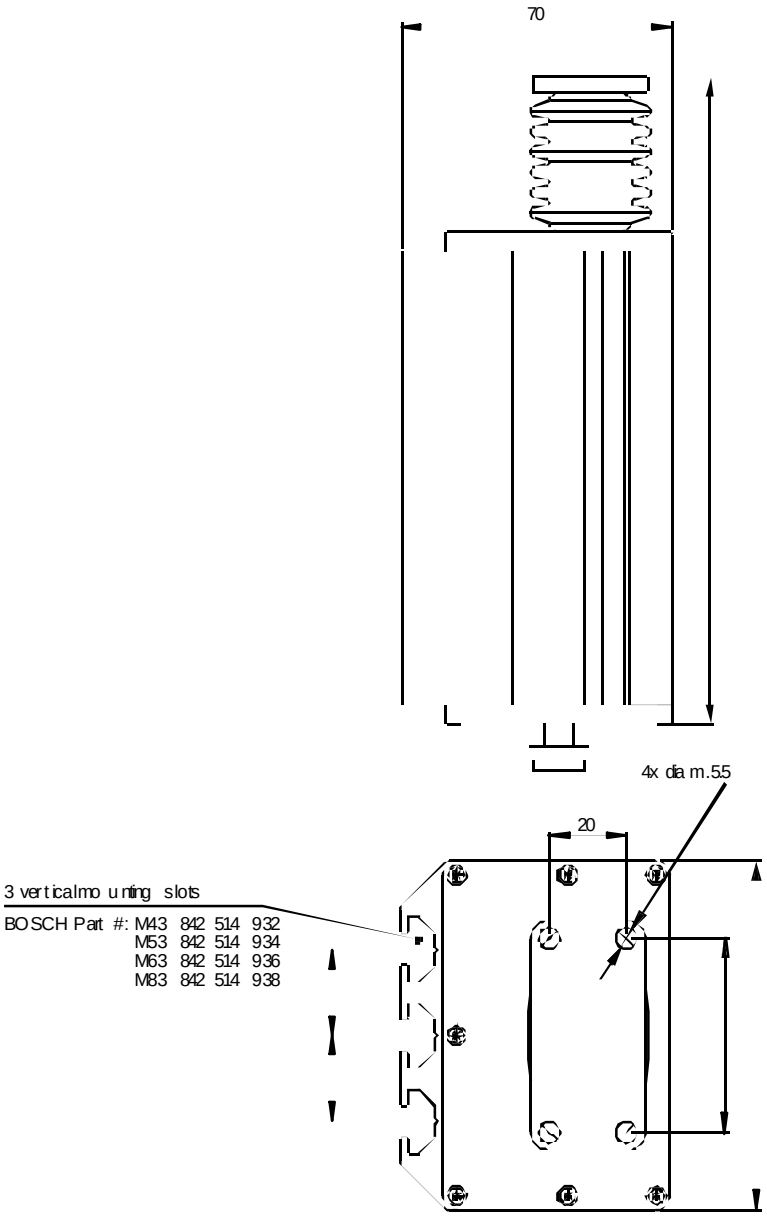


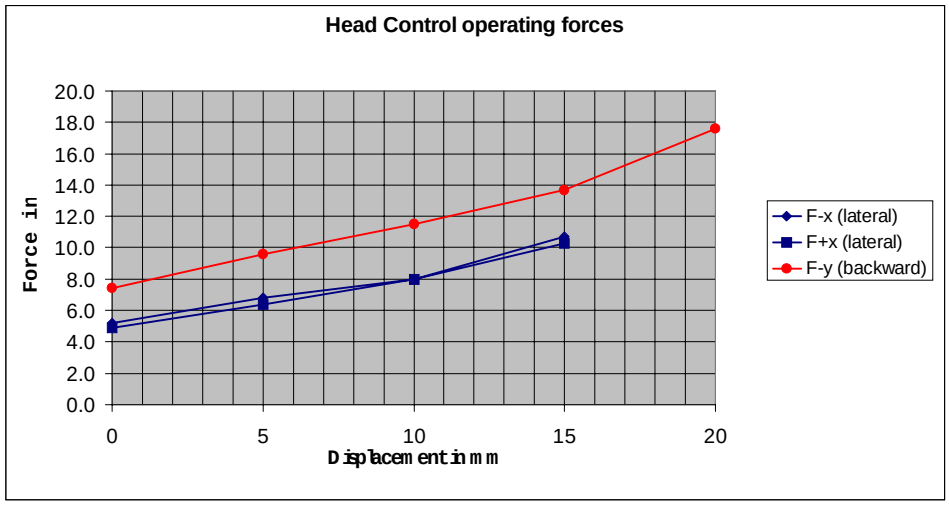
Fig. 29: *Mounting dimensions, 1713-5010 Headcontrol*

Specifications

Table 20: *Specifications for Headcontrol*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximum voltage (no damage to the devices)	35 V
Standby current	4 mA
Operating current, typical	41 mA
Operating force	see figure below
Operating ambient temperature range	-25°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90% RH
Weight	1.02 kg
Case material	aluminum
Case sealing	IP54

Fig. 30: *Operating force of Headcontrol*



Operating Instructions

Note that an **MFS** (Multi-Function Switch) and an LCD Display are necessary to operate the MC-2 system with a Headcontrol.

Commands

The Headcontrol allows head movement in only three directions (left, right, reverse).

- Default direction is always forward
- There are two ways to toggle between “Forward” and “Reverse” commands:
  - A short head movement in reverse
  - MFS short if Drive 1 through 4 is selected

Note that the parameter *MFS Double Command* must be set. Connect a Handheld Programmer to the system. Go to *Program / MFS* and set the *MFS Double Command.*

Table 21: *Commands for Headcontrol*

Command	Input assigned
On	MFS long
Off	MFS long or ON/OFF button if Hand Control is in system
Previous	Head movement reverse >50%, if indicator ▲ is shown
Next	Head movement reverse >50%, if indicator ▼ is shown
Select	Head movement right >50%
ESC	Head movement left > 50%
ESC	MFS 2x short
T	After programmable timeout, screen goes up one level

Calibrate

Recalibrating is recommended when wheelchair movement is not proportional to head deflection or the maximum speed cannot be reached.

To execute ‘Calibrate,’ connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Headcontrol/Calibrate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Headcontrol and choose *Calibrate*. The screen will guide you through the process.

Assign Direction

‘Assign Direction’ is a helpful function for assigning head movements to wheelchair driving. The Headcontrol direction may be ignored during installation.

To execute ‘Assign Direction,’ connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Headcontrol/Assign Direction*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Headcontrol and choose *Assign Direction*. The screen will guide you through the process.

Evaluation Mode

The evaluation mode is a helpful function for the user to practice the commands used to operate the power wheelchair.

In the evaluation mode the user is prompted to imitate a randomly generated command. At the end of the pre-selected time of the 'game,' the user receives a summary of the total number of commands and the total number of score points.

To execute 'Evaluate,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Headcontrol/Evaluate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on the Headcontrol and choose *Evaluate*. The screen will guide you through the process.

Driving and Using the AUX Function

Switching on the system with the MFS long command brings up the menu. Selecting from the menu one of the commands listed above causes the desired command (Drive or AUX function) to be issued. An MFS long command will cause an emergency stop.

7 1711-5010 SIP & PUFF

Overview

The Sip & Puff input module is a comfortable and easy-to-use Specialty Input device of the modular CURTIS MC-2 system. All pressure levels are individually programmable. Four-pressure or two-pressure modes are programmable.

Fig. 31: *1711-5010 Sip & Puff*

Since the Sip & Puff is a Specialty Input device, an LCD with an MFS is mandatory.

Features

- ✓ Four-pressure or two-pressure modes are programmable.
- ✓ Four different driving modes can be customized for different conditions.
- ✓ Easy menu handling together with the 1712-6010 LCD Display.
- ✓ Evaluation mode helps the user to learn the commands without driving the chair.
- ✓ Sip & Puff pressures are easily and fully adjustable with the Curtis Handheld Programmer or the PC Programming Station.
- ✓ Fully compatible with the Curtis Handheld Programmer for testing, diagnostics, and parameter adjustments.
- ✓ Advanced capability with PC interface.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Software update by OEM through any connector.
- ✓ Meets US and European Standards. The Sip & Puff is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.

Installation

Installing Sip & Puff

The overall dimensions and mounting dimensions for the 1711-5010 Sip & Puff are shown in the figure below.

Sip & Puff can be oriented in any position, but the location should be carefully chosen to keep the device as clean and dry as possible. Always run the air tube below the Sip & Puff.

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Dimensions

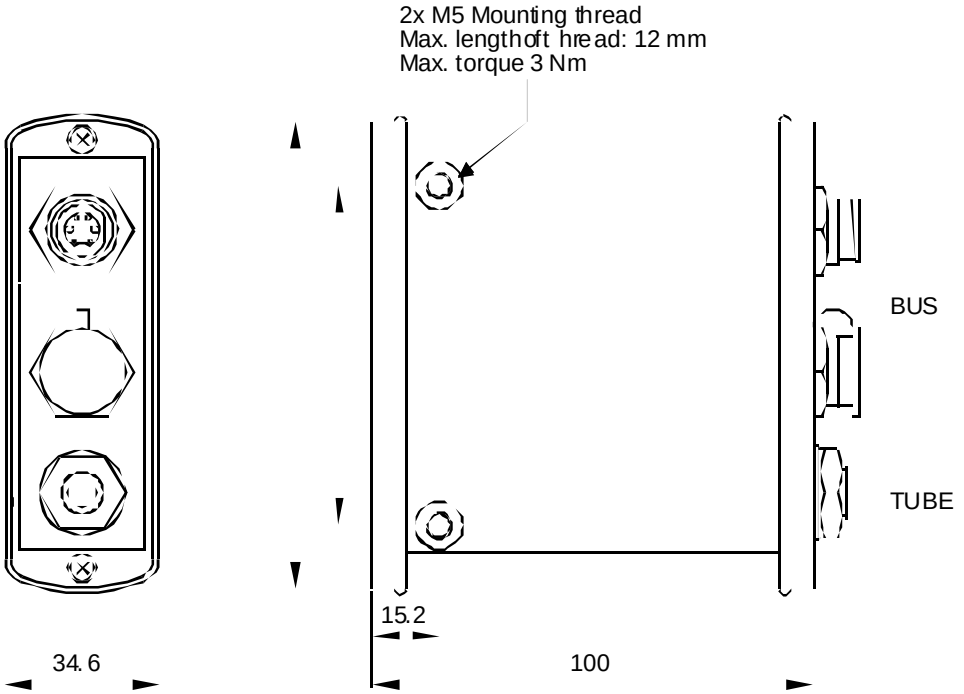


Fig. 32: *Mounting dimensions, 1713-5010 Sip & Puff*

Specifications

Table 22: *Specifications for Sip & Puff*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximum voltage (no damage to the devices)	35 V
Standby current	4 mA
Operating current, typical	78 mA
Breath pressure range	0.25 kPa to 6.78 kPa
Operating ambient temperature range	-25°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90% RH
Tube diameter	1/4 "
Weight	0.24 kg
Case material	aluminum
Case sealing	IP54

Operating Instructions

Note that an **MFS** (Multi-Function Switch) and an LCD Display are necessary to operate the MC-2 system with Sip & Puff, regardless of whether two- or four-pressure mode is selected.

Commands Common to Four-Pressure and Two-Pressure Sip & Puff

Table 23: *Commands for Sip & Puff*

Command	**Input assigned**
On	MFS long
Off	MFS long

Commands for Four-Pressure Sip & Puff

Table 24: *Commands for four-pressure Sip & Puff*

Command	Input assigned
Forward	Hard puff
Reverse	Hard sip
Right	Soft puff
Left	Soft sip
Previous	Hard puff
Next	Hard sip
Select	Soft puff
ESC	Soft sip
ESC	MFS short
T	after programmable timeout, screen goes one level up

The above drive commands are the default values. Different assignments are possible (see the Parameters section).

Commands for Two-Pressure Sip & Puff

Table 24: *Commands for two-pressure Sip & Puff*

Command	Input assigned
Forward	Short puff followed by a continuous puff
Reverse	Short sip followed by a continuous sip
Right	Continuous puff
Left	Continuous sip
Previous	2 short puffs
Next	2 short sips
Select	1 short puff
ESC	1 short sip
ESC	MFS short
T	After programmable timeout, screen goes up one level

The above drive commands are the default values. Different assignments are possible (see the Parameters section).

Pressure Adjustment

The 'Adjust Pressures' function helps to adjust the desired pressures interactively.

To execute 'Adjust Pressures,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Sip & Puff/Adjust Pressures*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on Sip & Puff and choose *Adjust Pressures*. The screen will guide you through the process.

Calibrate

The 'Calibrate' function calibrates Sip & Puff. This is necessary if the pressure in the neutral position is out of range (not zero) (see *Monitor Test Data / Pressure*).

To execute 'Adjust Pressures,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Sip & Puff/Calibrate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on Sip & Puff and choose *Calibrate*. The screen will guide you through the process.

Evaluation Mode

The evaluation mode is a helpful function for the user to practice the commands used to operate the power wheelchair.

In the evaluation mode the user is prompted to imitate a randomly generated command. At the end of the pre-selected time of the 'game,' the user receives a summary of the total number of commands and the total number of score points.

To execute 'Evaluate,' connect the Handheld Programmer or the PC Programming Station to the MC-2 system.

Handheld Programmer

Go to *Program/Sip & Puff/Evaluate*. The screen will guide you through the process.

PC Programming Station

Select *Device Functions* on Sip & Puff and choose *Evaluate*. The screen will guide you through the process.

Driving and Using the AUX Function

Switching on the system with the MFS long command brings up the menu. Selecting from the menu one of the commands listed above causes the desired command (Drive or AUX function) to be issued. An MFS long command will cause an emergency stop.

8 1708-7015 SEAT MODULE

Overview

The Curtis Model 1708-7015 provides control of up to five seat actuators. End-of-travel detection is possible with limit switches or programmable current thresholds.

The 1708-7015 Seat Module suits all power wheelchairs with automatic seat adjustment. It allows the actuators to be operated from any MC-2 Input Device.

Fig. 33: *1708-7015 Seat Module*

Features

- ✓ Controls up to five seat actuators.
- ✓ Simultaneous operation of up to three motors possible.
- ✓ Motor speed proportional to joystick position.
- ✓ Acceleration, deceleration, and maximum speed are programmable to user needs.
- ✓ Adjustable current threshold to detect end-of-travel.
- ✓ Provides inputs for limit switches or drive inhibit switches.
- ✓ Easily and fully programmable using the Curtis Handheld Programmer or the PC Programming Station.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Software update by OEM through any connector.
- ✓ Meets US and European Standards. The Seat Module is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.

Installation and Wiring

Installing the Seat Module

The overall dimensions and mounting dimensions for the 1708-7015 Seat Module are shown in the figure below.

The Seat Module can be oriented in any position, but the location should be carefully chosen to keep the device as clean and dry as possible.

Dimensions

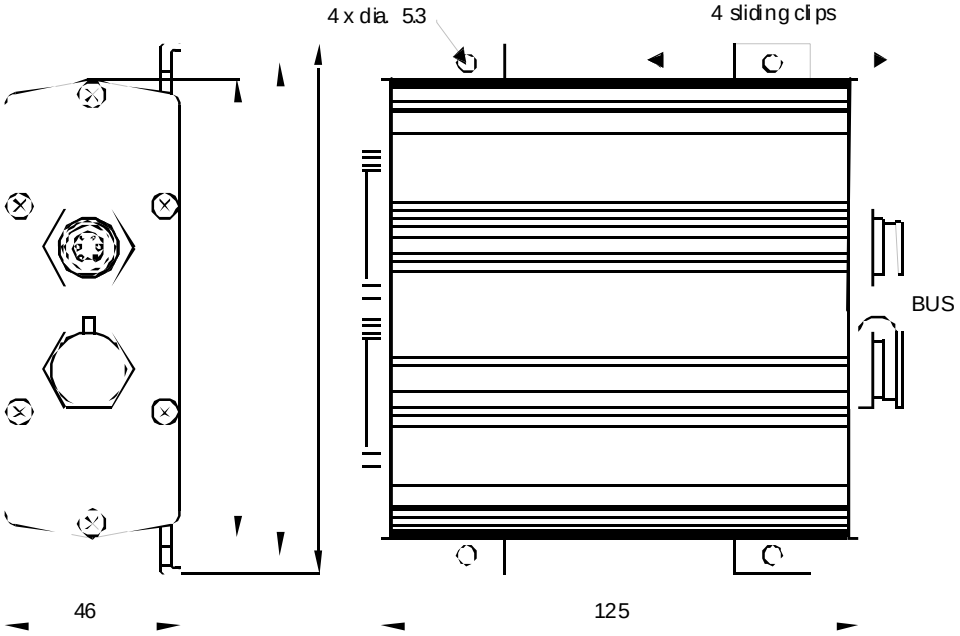


Fig. 34: *Mounting dimensions, 1708-7015 Seat Module*

Wiring the 1708-7015 Seat Module

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Low-Current Connection

The D-Sub connectors provide control for the seat motors. The mating connector for the switch input (limit switches and drive inhibit switches) is a 15-pin D-Sub with socket contacts, and the mating connector for the seat motors is a 15-pin D-Sub with pin contacts.

Wiring Diagram

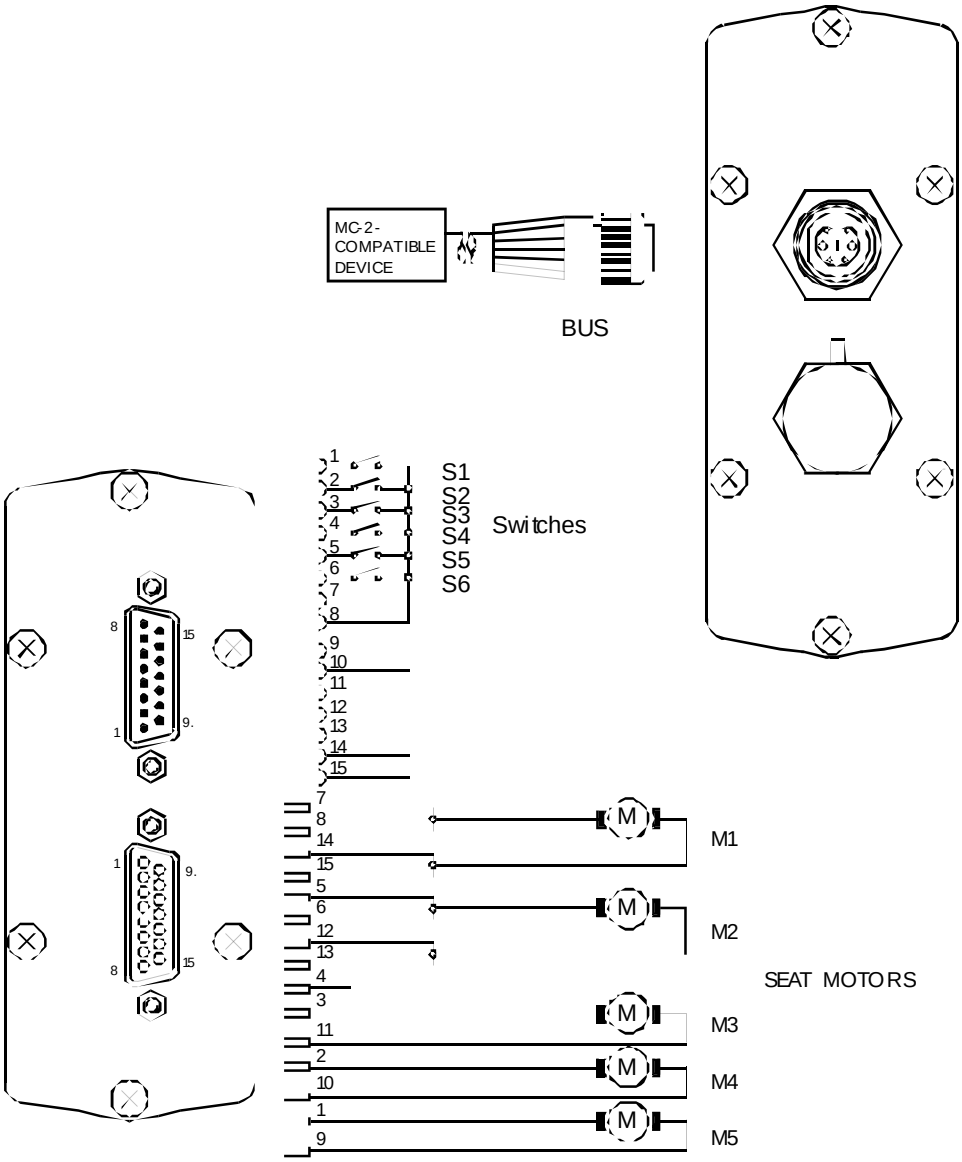


Fig. 35: *Wiring configuration, 1708-7015 Seat Module*

Specifications

Table 25: *Specifications for Seat Module*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximum voltage (no damage to the devices)	35 V
Standby current	5 mA
Operating current, typical (no actuator turns)	109 mA
Current rating, Actuators	
Max. total current (Bus fuse in Controller)	13 A
10 sec. for M1 or M2	13 A*
Continuous for M1 or M2	10 A*
10 sec. for M3 to M5	6 A*
Continuous for M3 to M5	4 A*
* Single operation:	each motor in each direction
* Simultaneous operation:	up to 1 high current (M1, M2) and 3 low current motors (M3 to M5) in the same direction
Operating ambient temperature range	-25°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90% RH
Weight	0.62 kg
Case material	aluminum
Case sealing	IP54

Configuration for Seat Module

A first-time configuration is necessary before using the Seat Module. A distinction is to be made between an MC-2 System with Hand Control and an MC-2 System with LCD. The System with Hand Control allows assignment of a maximum of four AUX channels. With the LCD up to eight assignments are possible.

Seat Module and Hand Control Configuration

At least the following modules must be connected: Controller, Hand Control, Seat Module, and PC Programming Station.

Note: This configuration can only be performed with the PC Programming Station.

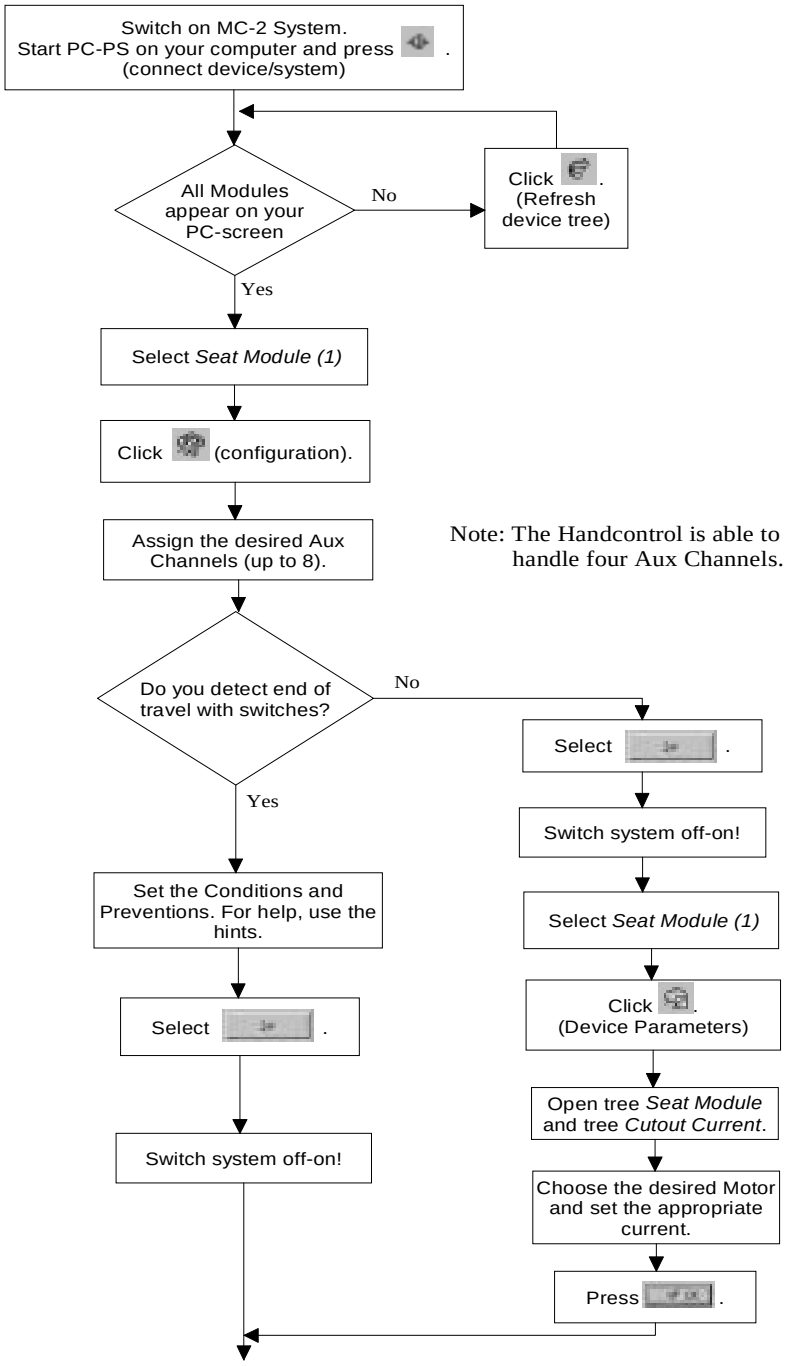
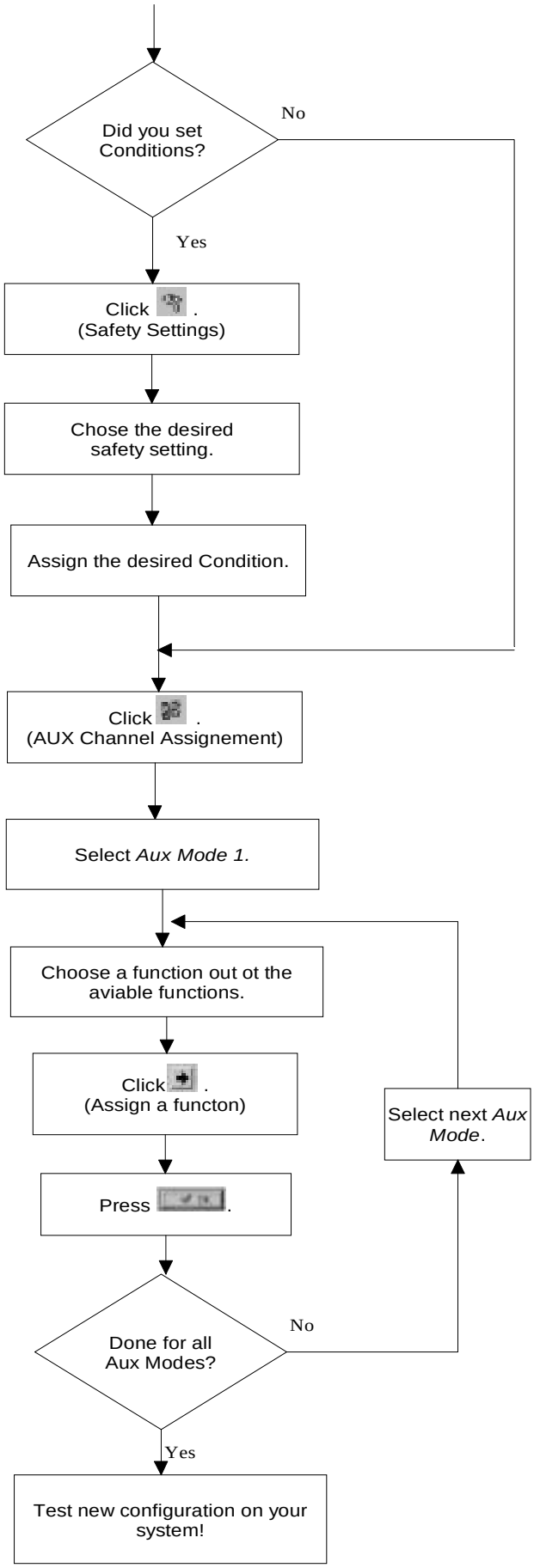


Fig. 36: *Configuration for Seat Module and Hand Control, part 1/2*

Fig. 37: *Configuration for Seat Module and Hand Control, part 2/2*



Seat Module and LCD Configuration

At least the following modules must be connected: Controller, LCD, Seat Module, Hand Control or Specialty Input Device with MFS and PC Programming Station.

Note: This configuration can only be performed with the PC Programming Station.

Fig. 38: *Configuration for Seat Module and LCD, part 1/2*

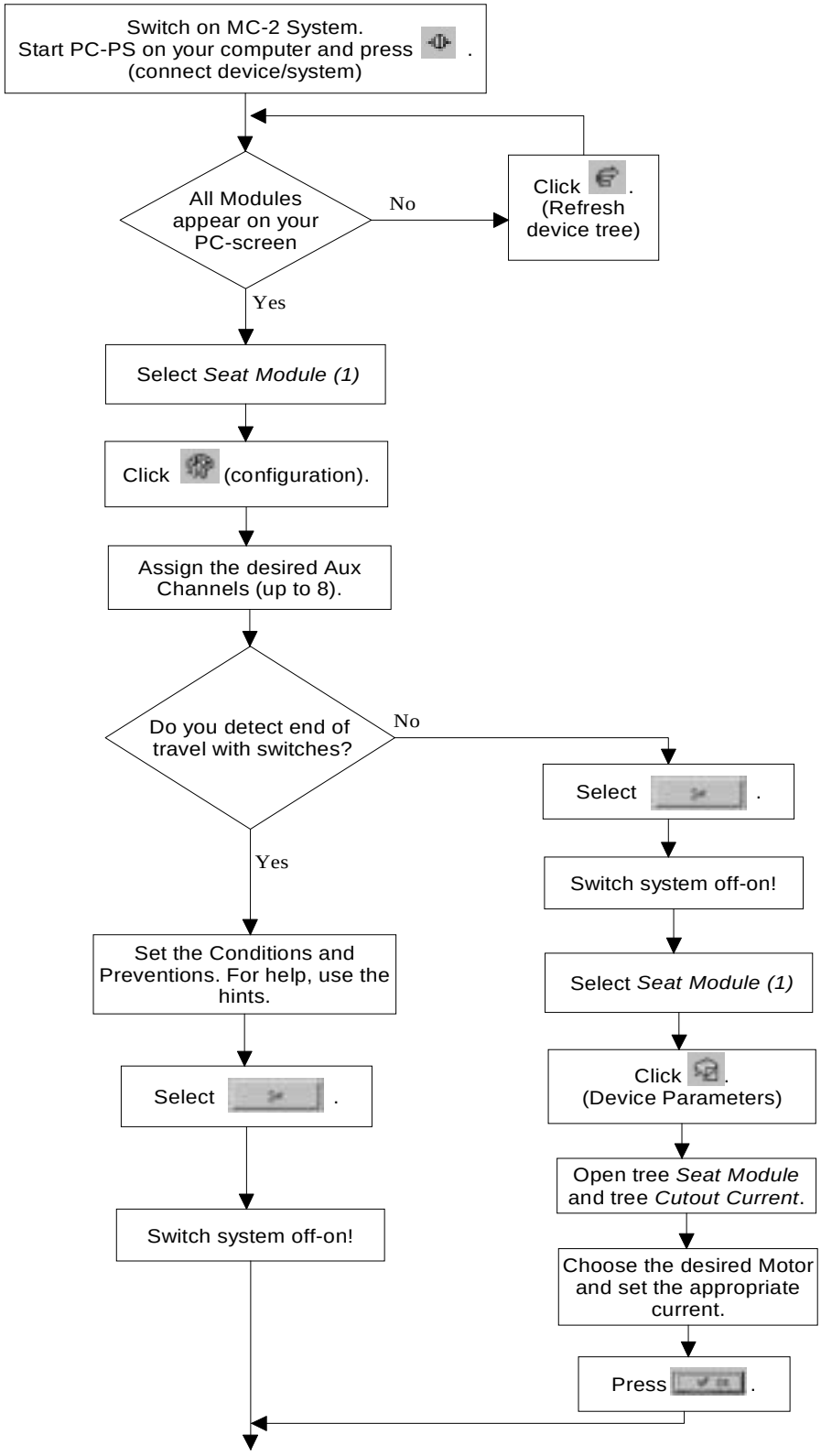
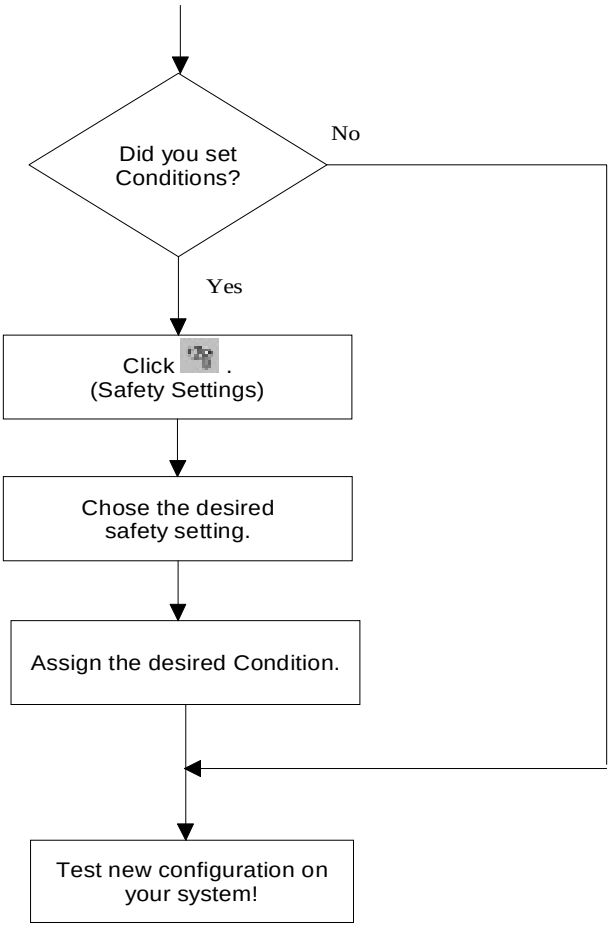


Fig. 39: *Configuration for Seat Module and Hand Control, part 2/2*



9 1709-7018 ECU MODULE

Overview

The Curtis Model 1709-7018 Environment Control Unit (ECU) provides control of up to eight switch-type outputs. It allows operation of on-chair devices such as page turners, audio devices, small lights, etc. from any MC-2 System Input Device.

Fig. 40: *1709-7018 ECU Module*

Features

- ✓ Controls up to eight switch-type outputs.
- ✓ Each output can be set for latching or non-latching mode.
- ✓ All outputs are insulated relay contacts and protected against overcurrent.
- ✓ Easily and fully programmable using the Curtis Handheld Programmer or the PC Programming Station.
- ✓ Uses internationally accepted CAN BUS technology (used in the automobile industry).
- ✓ Software update by OEM through any connector.
- ✓ Meets US and European Standards. The ECU Module is designed to meet:
  - ISO 7176-14
  - ISO 7176-21
  - IEC 529 class IP54
  - DIN V VDE 0801 class 3
  - TÜV Approval
- ✓ Documents for international approvals available.

Installation and Wiring

Installing the ECU Module

The overall dimensions and mounting dimensions for the 1708-7015 Seat Module are shown in the figure below.

The ECU Module can be oriented in any position, but the location should be carefully chosen to keep the device as clean and dry as possible.

Dimensions

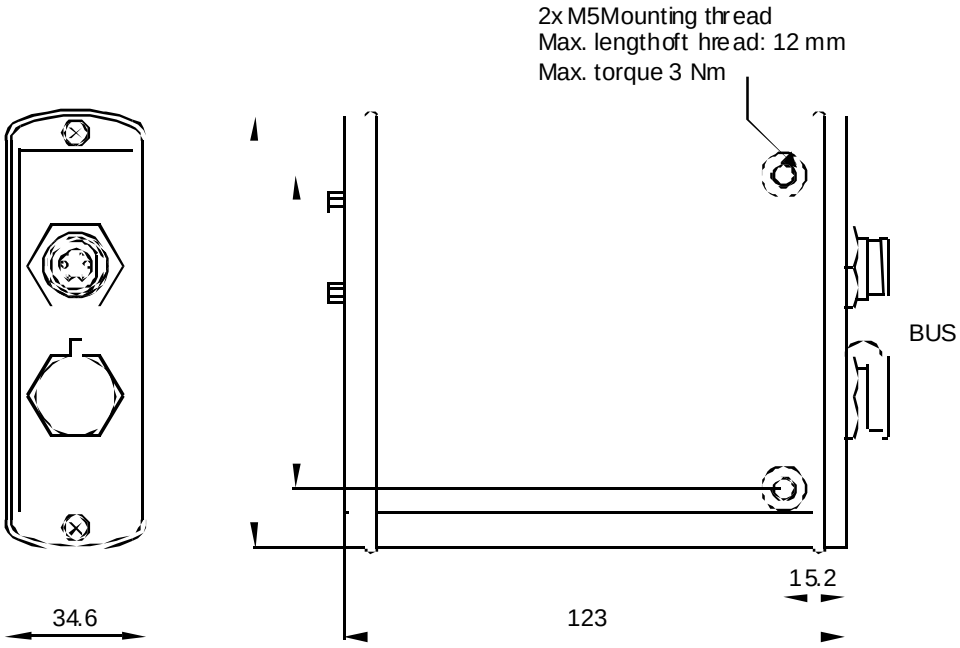


Fig. 41: *Mounting dimensions, 1709-7018 ECU Module*

Wiring the 1709-7018 ECU Module

Bus Connection

Make sure the ring of the connector is locked properly. The Bus Connection is a proprietary Curtis CONXALL connector. There is a wide variety of cable lengths available.

Low-Current Connection

The D-Sub connector provides control of the switches. The mating connector for the switch output is a 15-pin D-Sub with pin contacts.

Wiring Diagram

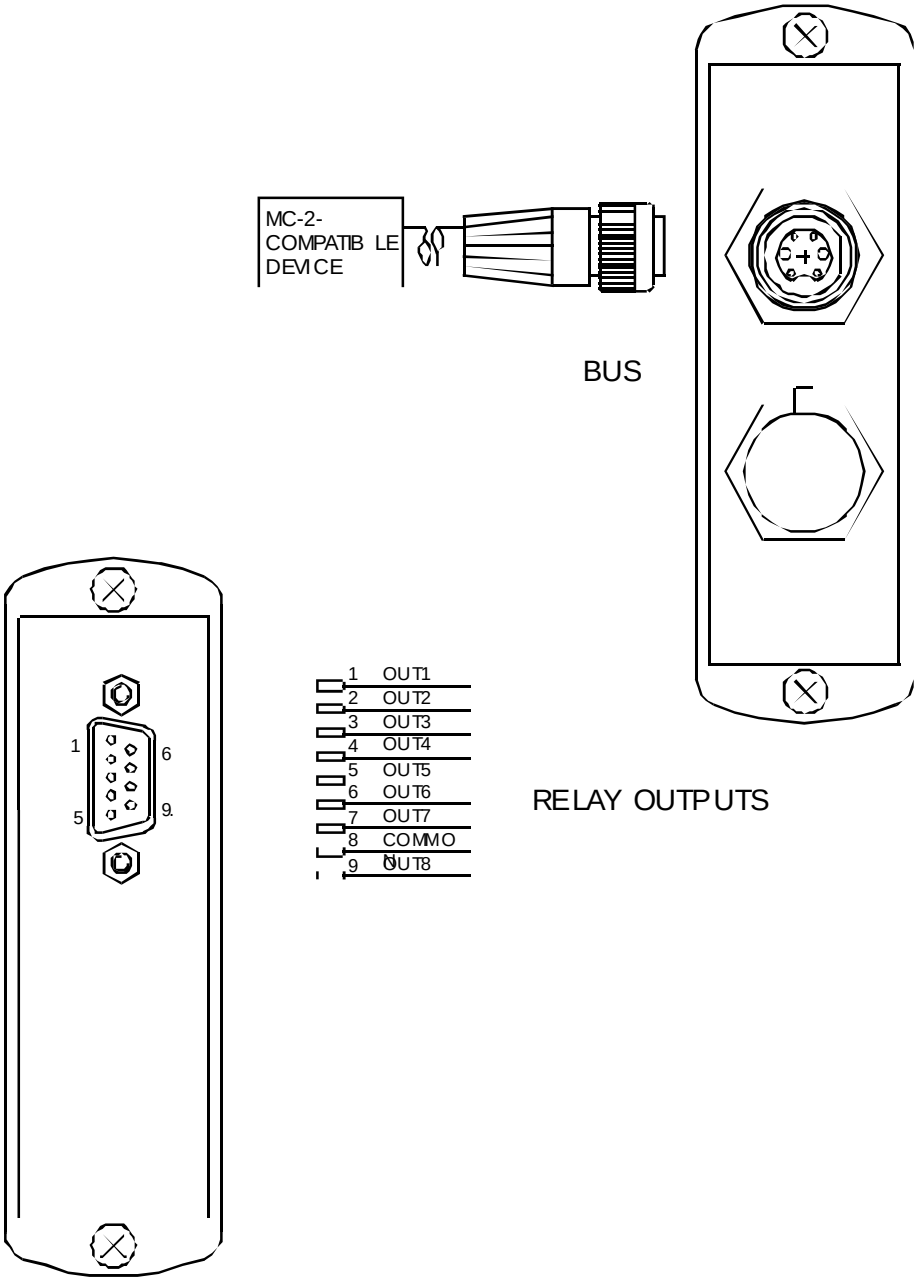


Fig. 42: *Wiring configuration, 1709-7018 ECU Module*

Specifications

Table 26: *Specifications for ECU Module*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	16 - 33 V
Maximum voltage (no damage to devices)	35 V
Standby current	4.5 mA
Operating current, typical	71 mA
Continuous output current	2 A (common line, fused)
Maximum switching voltage	33 V
Operating ambient temperature range	-25°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90% RH
Weight	0.35 kg
Case material	aluminum
Case sealing	IP54

Configuration of the ECU Module

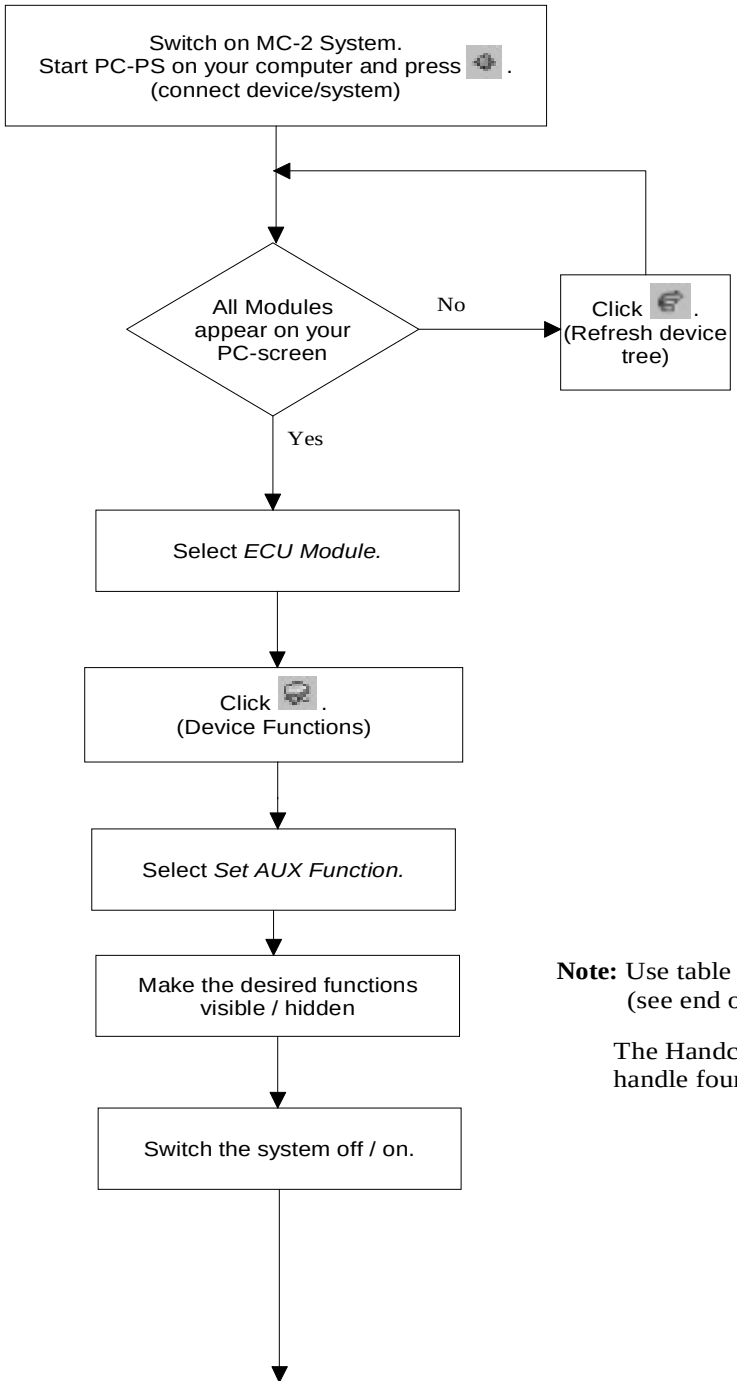
A first-time configuration is necessary before using the ECU Module. A distinction is to be made between an MC-2 System with Hand Control and an MC-2 System with LCD. The System with Hand Control allows assignment of a maximum of four AUX channels. With the LCD up to eight assignments are possible.

ECU and Hand Control Configuration

At least the following modules must be connected: Controller, Hand Control, ECU Module, and PC Programming Station.

Note: This configuration can only be performed with the PC Programming Station.

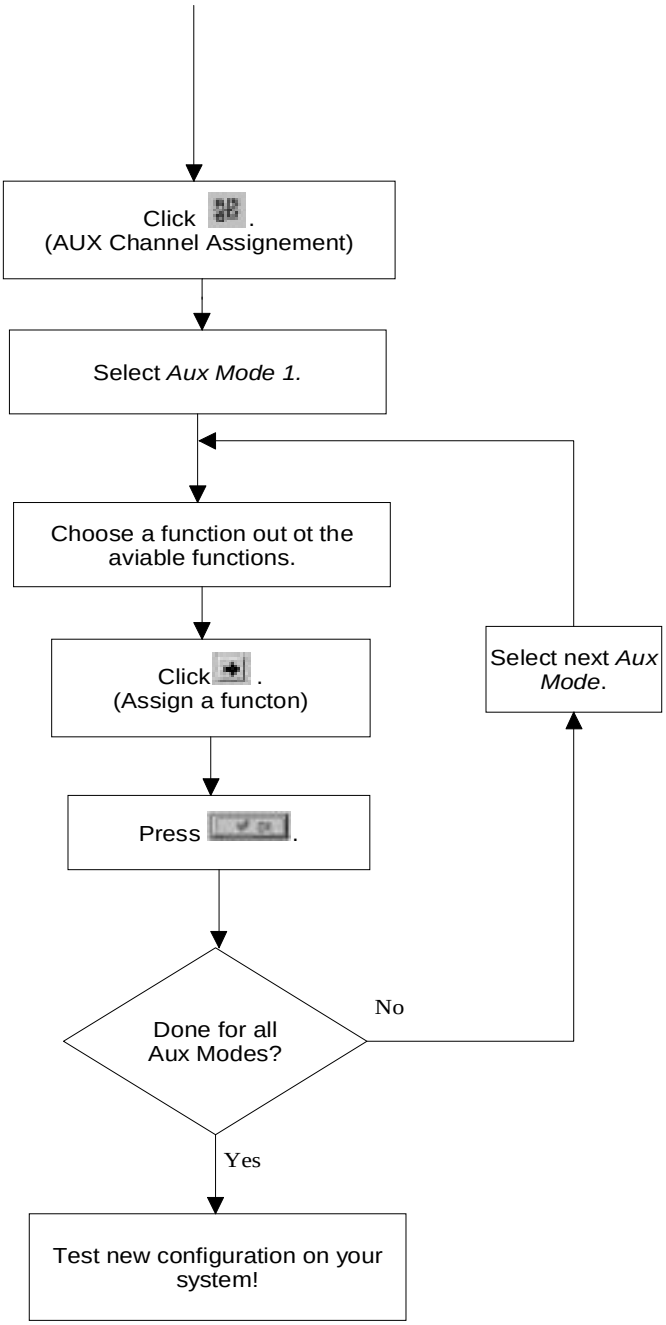
Fig. 43: *Configuration of the ECU Module and Hand Control, part 1/2*



Note: Use table 'Function Menus' (see end of this chapter).

The Handcontrol is able to handle four Aux Channels.

Fig. 44: *Configuration for ECU Module and Hand Control, part 2/2*

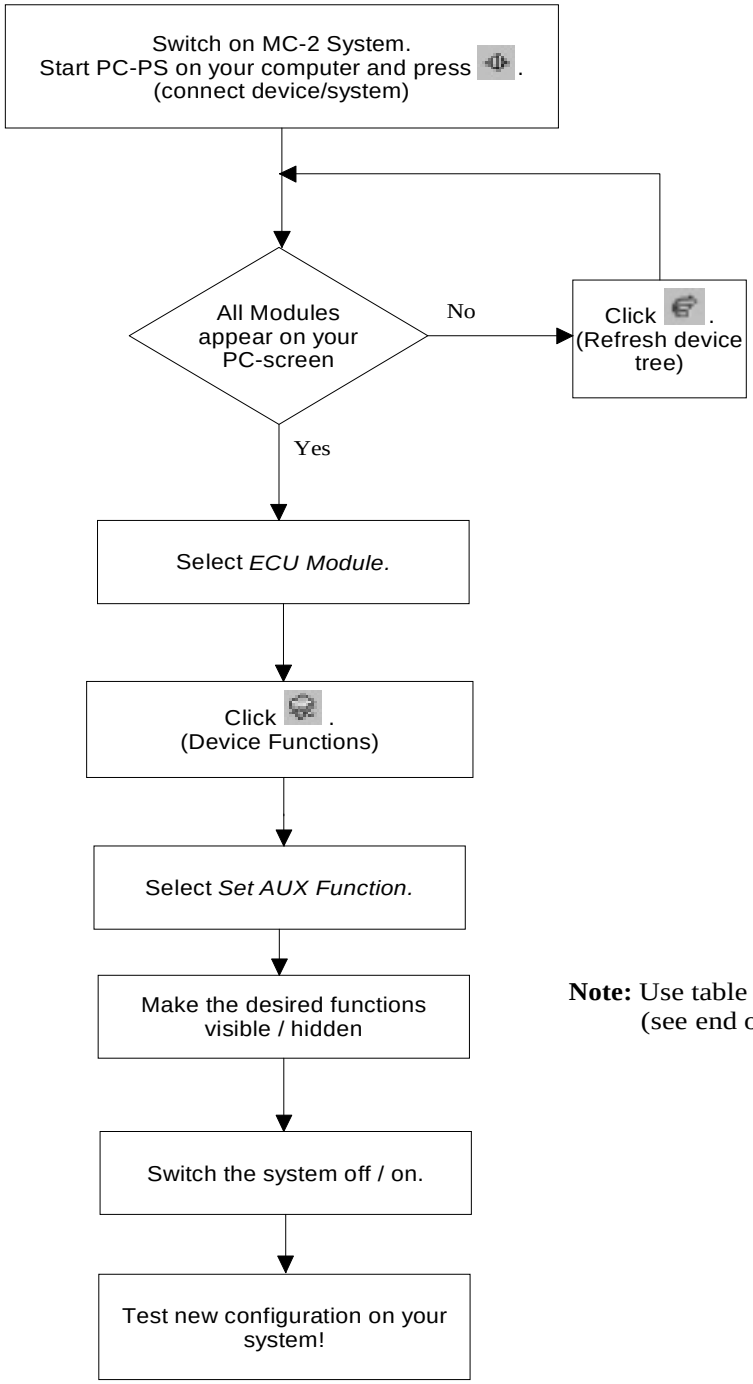


ECU Module and LCD Configuration

At least the following modules must be connected: Controller, LCD, ECU Module, Hand Control or Specialty Input Module with MFS, and PC Programming Station.

Note: This configuration can only be performed with the PC Programming Station.

Fig. 45: *Configuration for ECU Module and LCD*



Note: Use table 'Function Menus' (see end of this chapter).

Function Menu for ECU Module Configuration

Table 27: *Function Menu for ECU Module*

Function number	Relay name	Input Command	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8
0		Forward	On/Off							
		Reverse		On/Off						
1		Forward			On/Off					
		Reverse				On/Off				
2		Forward					On/Off			
		Reverse						On/Off		
3		Forward							On/Off	
		Reverse								On/Off
4		Forward	On							
		Reverse	Off							
5		Forward		On						
		Reverse		Off						
6		Forward			On					
		Reverse			Off					
7		Forward				On				
		Reverse				Off				
8		Forward					On			
		Reverse					Off			
9		Forward						On		
		Reverse						Off		
10		Forward							On	
		Reverse							Off	
11		Forward								On
		Reverse								Off
12		Forward	On/Off							
		Right		On/Off						
		Reverse			On/Off					
		Left				On/Off				
13		Forward					On/Off			
		Right						On/Off		
		Reverse							On/Off	
		Left								On/Off

- Functions 0 through 3 are not latched functions.
- Functions 4 through 11 are latched functions.
- Functions 12 and 13 are ‘cross’ functions; each direction switches one relay. They are not latched functions.

10 1311- 4101 HANDHELD PROGRAMMER

Overview

The Curtis Model 1311-4101 Handheld Programmer allows you to program, test, and diagnose Curtis Speed Controllers and Auxiliary Devices.

Fig. 46: *1311-4101 Handheld Programmer*

Features

- ✓ Compatible with Curtis speed controllers and auxiliary devices.
- ✓ Emulates Curtis 1307 Programmer.
- ✓ Four-Key “Windows-like” menu navigation.
- ✓ + and - Keys for “Real Time” access to parameters.
- ✓ Detail Screen shows units and bar graph.
- ✓ Three Bookmark Keys provide fast swapping between different menus (e.g., Speed Adjustment and Output Voltage Monitoring).
- ✓ Graphic Display with up to seven lines.
- ✓ Pop-up windows for user information.

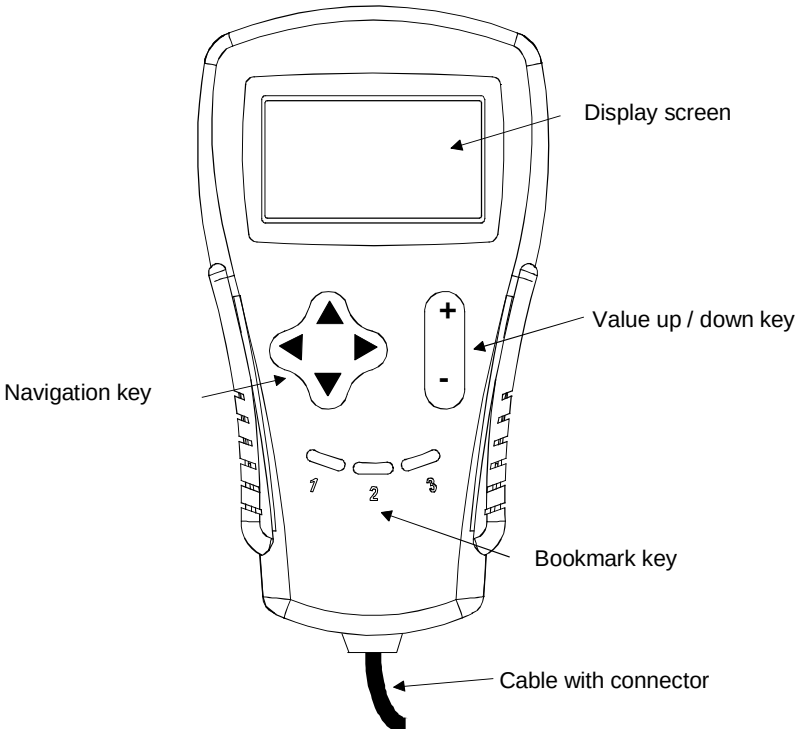
Specifications

Table 28: *Specifications for Model 1311-4101 Handheld Programmer*

Battery voltage = 24 V unless otherwise noted	
Nominal input voltage	24 V
Operating voltage range	8 - 38 V
Maximum voltage (no damage to devices)	40 V
Operating current, typical	34 mA
Operating ambient temperature range	-10°C to 50°C
Storage temperature range	-40°C to 70°C
Operating and storage humidity range	0 to 90% RH
Weight	0.38 kg
Case material	plastic

Operating Instructions

Fig. 47: *Functionality of the Model 1311-4101 Handheld Programmer*



Cable with Connector

Can be connected to the front connector via the Hand Control or to any connector in the system.

Navigation Key

The Navigation Key moves the screen cursor up or down (top or bottom arrow) and opens or closes subsets of parameters (left and right arrows).

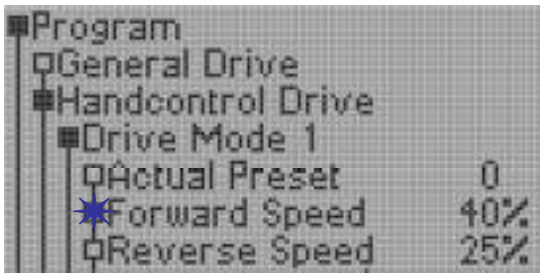
Value Up / Down Key

The Value Up / Down Key changes the value of the parameter indicated by the cursor (no need for separate “Save” function).

Bookmark Key

The three bookmark keys allow you to quickly go back to your selected parameters without having to scroll up and down the screen. Hold a Bookmark Key down for three seconds to bookmark the displayed screen. Press momentarily to jump to the previously bookmarked screen.

Fig. 48: *Possible screen of the Model 1311-4101 Handheld Programmer*



1) Turn wheelchair power “ON”.
2) Connect the cable/connector to the Hand Control or any free connector. The display screen will be activated shortly.
3) To open the Program Menu, press the right arrow on the Navigation key at *Program*.
4) Use the Navigation key (top and bottom arrows) to scroll up or down the listing of the parameters. In order to avoid long scrolling times, the different parameters have been arranged into subset menus.
5) To open the Hand Control Drive menu, move the cursor down to the respective parameter (down arrow) and then press the right arrow.
6) Open the Drive mode to be modified in the same way (either Drive Mode 1, 2, 3 or 4).
7) Scroll down to the parameter you wish to change.
8) Then press the Value Up / Down Key for the preferred setting, or press the right arrow to show a bar graph with min. / max. values, and then press Up / Down to change the value.
9) There is no need to press any “Set key,” since the 1311 automatically recognizes your command.
10) Test drive the chair at any time.
11) To close a menu, press the Left Arrow on the Navigation Pad.
12) You can disconnect the Programmer at any time. Remember: on disconnecting the Programmer, you will lose any bookmarks that have been set.

11 PARAMETERS, MONITOR VALUES, ETC.

Overview

The Generic MC-2 has a large number of parameters that can be programmed by means of the 1311 Handheld Programmer or the Programming Station. These programmable parameters allow the wheelchair's performance characteristics to be customized to fit the needs of individual users.

The MC-2 also offers monitor values, which allow functions such as switches to be checked or values such as left motor current to be measured.

Note: The description of all parameters and monitor values is provided in the PC Programming Station.

Fig. 49: *Start screen after connecting the Model 1311-4101 Handheld Programmer*

Program

Includes all programming parameters. The list of parameters depends on the number of modules connected

Faults

Contains all warnings and faults (see Diagnostics and Troubleshooting) that have occurred. They are stored in the Fault History of each device.

For the uncorrected faults, go to the System Fault Monitor submenu.

Monitor

Includes a large variety of monitor values such as left motor current, battery voltage, or Mode Switch. The number of monitor values depends on the number of modules connected.

Information

Gives useful information about each connected module such as OEM info, reconfigured status, model number, serial number, manufacturing date, software version, hardware version, and protocol version.

Model 1311 Programmer Setup

Has all the necessary submenus for the Handheld Programmer (Program, Faults, Information).

Programmable Parameters

The programmable parameters are described in the PC Programming Station Manual (each parameter has a help button).

Existing functions, such as Joystick Calibrate, are described in the module-specific part of this manual.

Types of Parameters

There are three types of parameters:

- Drive Parameters (Forward Speed, Reverse Acceleration, ...)
- Control Parameters (Motor Impedance, Driven Wheel Diameter, ...)
- Device Parameters (Seat Motor 1–3 Timeout, Operating Range, ...)

Location of Parameters

Each device has its own parameters. For example, the sip threshold is located in the Sip & Puff Module, and the neutral deadband is in every module with a joystick.

Drive Parameters and Control Parameters are located in the controller.

What does this mean?

If a controller must be changed, you must copy the parameters and store their values into the new controller (see the PC Programming Station Manual).

Parameter Tree Structure

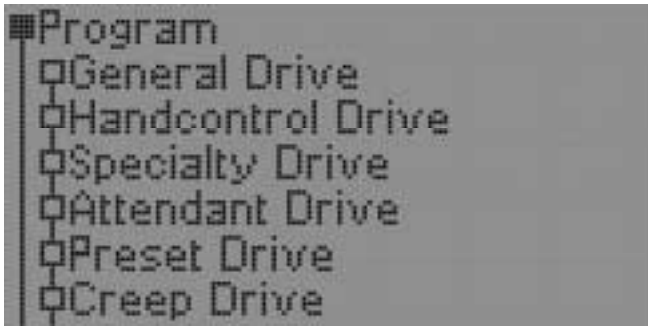


Fig. 50: *Screen after entering Program.*

General Drive

Includes parameters which have an influence on all different drive modes such as Max Speed, Max Turns, Fast Stop, Tracking, Emergency Stop.

Hand Control Drive

Includes the four drive modes of the Hand Control (speed, acceleration, etc.)

Specialty Drive

Includes the four drive modes for specialty inputs (Stand Alone, Headcontrol, Sip & Puff, Tash)

Attendant Drive

Includes one drive mode for the Attendant Control (speed, acceleration, etc.)

Preset Drive (for OEM only)

Presets define a set of factory values for all the speed, acceleration, and deceleration parameters. The following parameter set can be defined individually for 20 presets. The preset can be matched to any drive mode (Hand Control, Specialty, Attendant).

Creep Drive (for OEM only)

It is a safety Drive mode. The system goes into Creep Drive if any of the following conditions is present:

- Low / High battery voltage
- Left / Right motor disconnected
- High controller temperature

Drive Limits (for OEM only)

There are two menus for drive limits: Hand Control Drive and Specialty Drive. Limitations are applicable to all drive-relevant parameters (forward speed, turn acceleration, etc.)

Hand Control

Includes all Hand Control-relevant parameters (Neutral Deadband, Command Beep, etc.)

Controller

There are three or four menus, depending on the controller used: Motor & Wheels, Brake, Battery and Actuators, and, if applicable, Light and Indicators.

Seat Module, ECU, etc.

Includes the parameters of all additional modules connected to the system.

System

Includes several submenus such as Timing (Sleep Timeout, etc.), Learn Mode (disables driving for safe practicing), Feedback (Back-Up Alarm Drive 1, etc.), Reset Distance (Reset Trip, etc.).

Aux Mode Assign

Allows Aux Mode assignments via the Handheld Programmer. However, this operation is very complicated and is not recommended. Use the PC Programming Station for convenient assignments.

Menu Settings

Has a Main Menu submenu, which allows Program, Monitor, and Information menus to be hidden or shown on the LCD Display.

12 INSTALLATION CHECKLIST

Overview

Before first operating the vehicle, carefully go through the following checklist. If you find a problem while going through the checklist, refer to the diagnostics and troubleshooting section for further information.

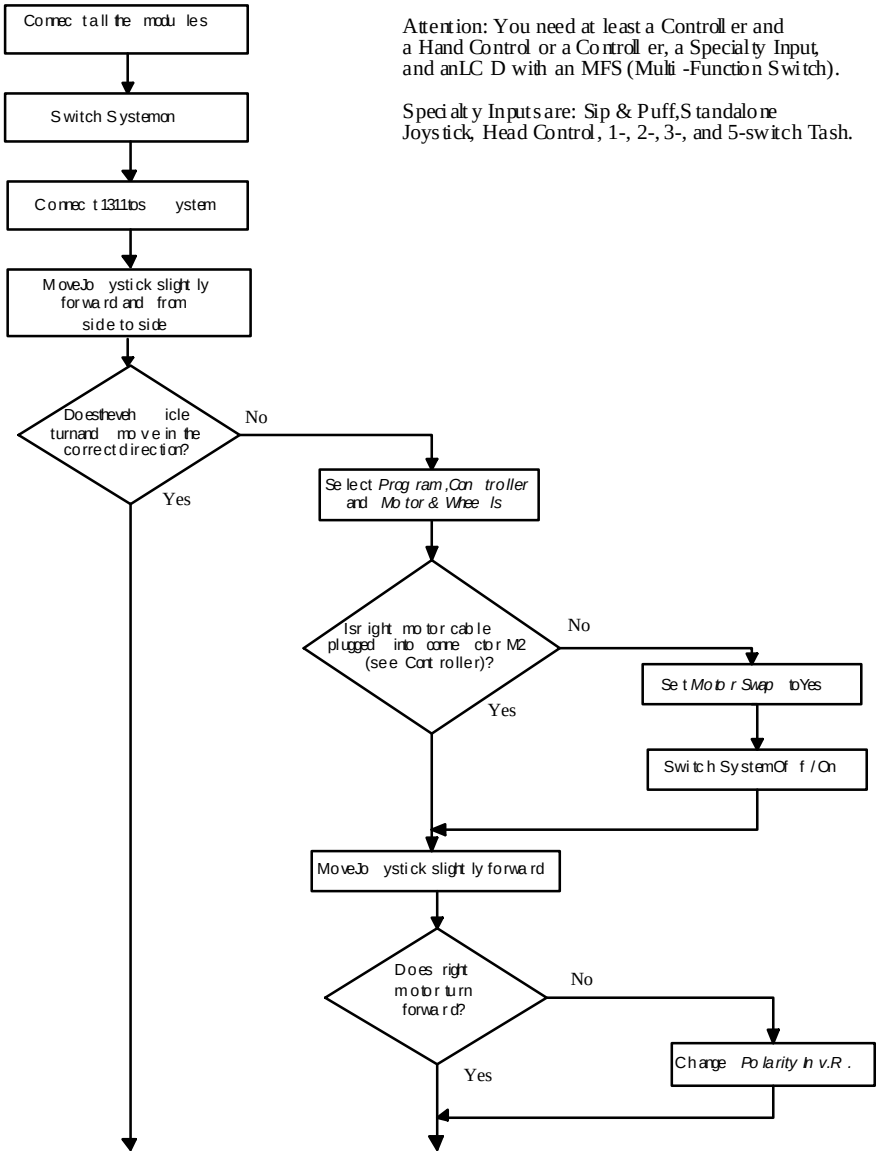
Initial Operation Phase

This procedure must be done when the system is mounted on a new vehicle for the first time.

Any combination of Modules with Handheld Programmer

Note: This configuration can also be performed using the PC Programming Station.

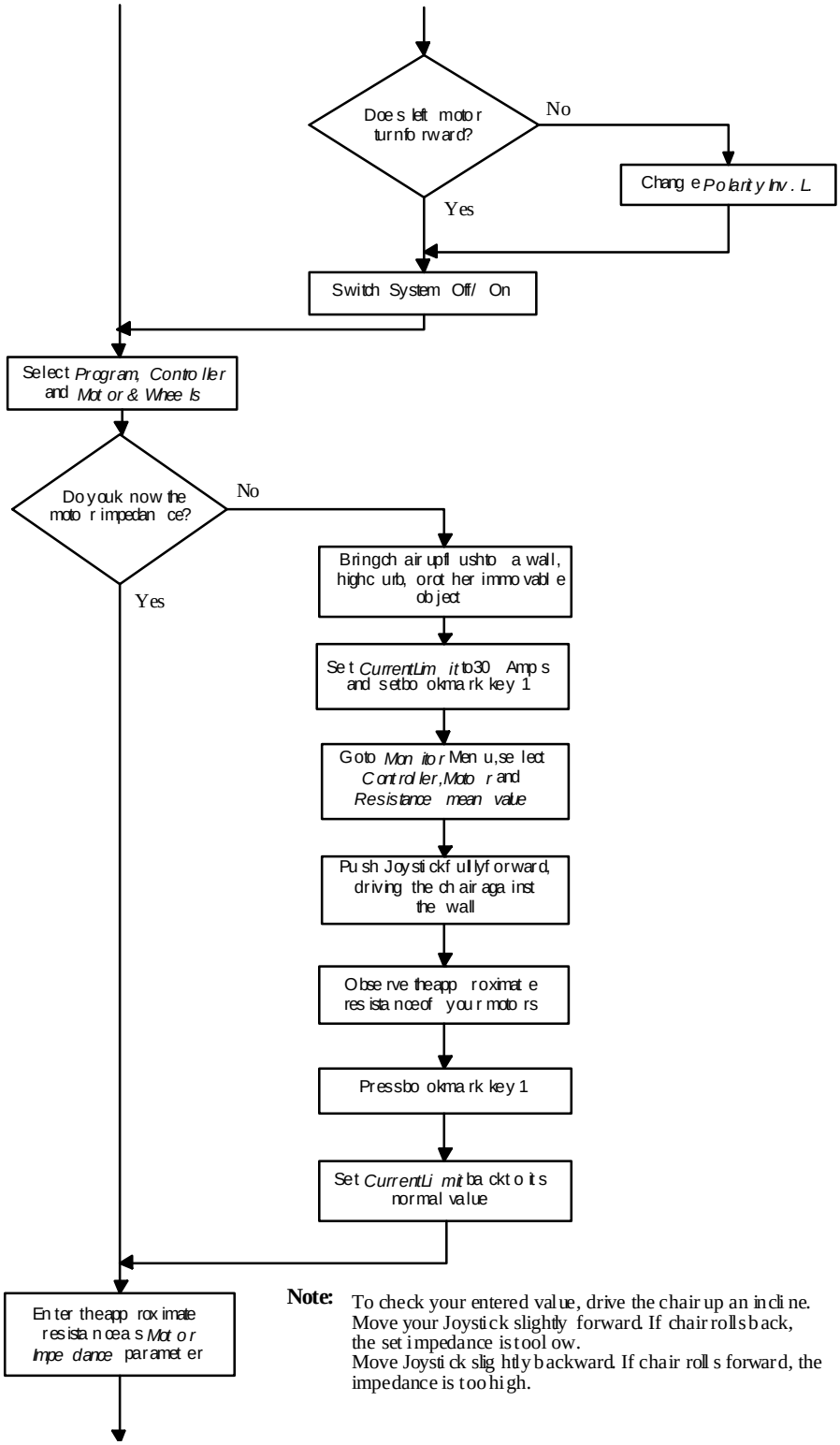
Fig. 51: *Initial Operation Phase 1/3.*



Attention: You need at least a Controller and a Hand Control or a Controller, a Specialty Input, and an LCD with an MFS (Multi-Function Switch).

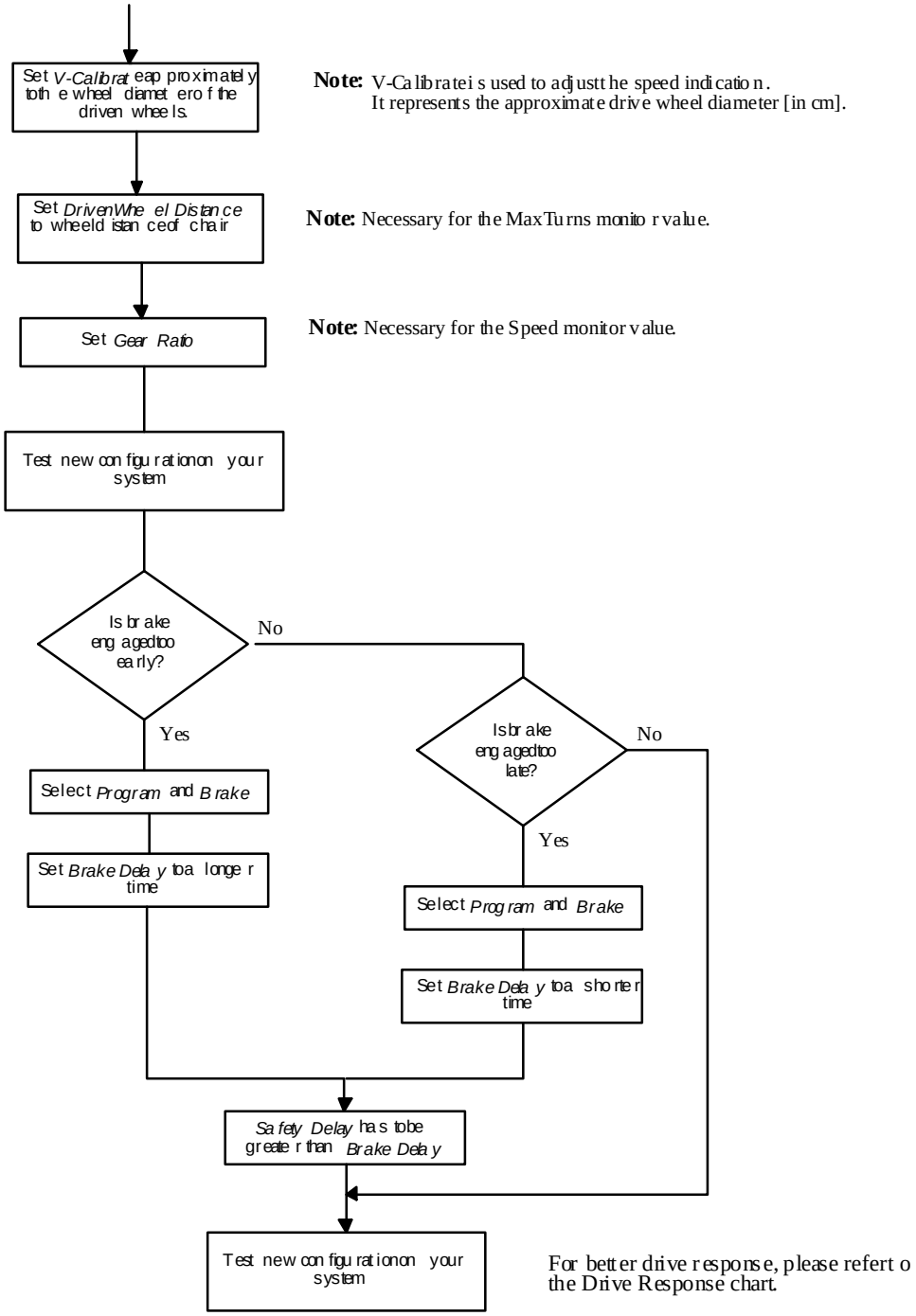
Specialty Inputs are: Sip & Puff, Standalone Joystick, Head Control, 1-, 2-, 3-, and 5-switch Tash.

Fig. 52: *Initial Operation Phase 2/3.*



Note: To check your entered value, drive the chair up an incline. Move your Joystick slightly forward. If chair rolls back, the set impedance is too low.
Move Joystick slightly backward. If chair rolls forward, the impedance is too high.

Fig. 53: *Initial Operation Phase 3/3.*



Note:

If the system is equipped with a Hand Control, the BDI LEDs begin cyclically scrolling up and down.

This situation indicates that the system checks itself for consistency. The duration of this phase is dependent on the number of devices that are connected. When the system is switched on for the first time with a new device connected, this initial phase lasts some seconds longer. This is because the new device has to be recognized and its profile data has to be stored in the non-volatile memory of the MC2-Controller.

13 WHEELCHAIR PERFORMANCE ADJUSTMENT

Overview

The MC-2 Generic system is a very powerful wheelchair control system. Its wide variety of adjustable parameters allows many aspects of vehicle performance to be optimized. This section provides an explanation of what the major tuning parameters do and instructions on how to use these parameters to optimize the performance of your chair.

Tuning the Drive Response

Before tuning the drive response make sure that the initial operation phase has been completed (detection of motor impedance).

Any combination of Modules with Handheld Programmer

Note: This configuration can also be performed using the PC Programming Station.

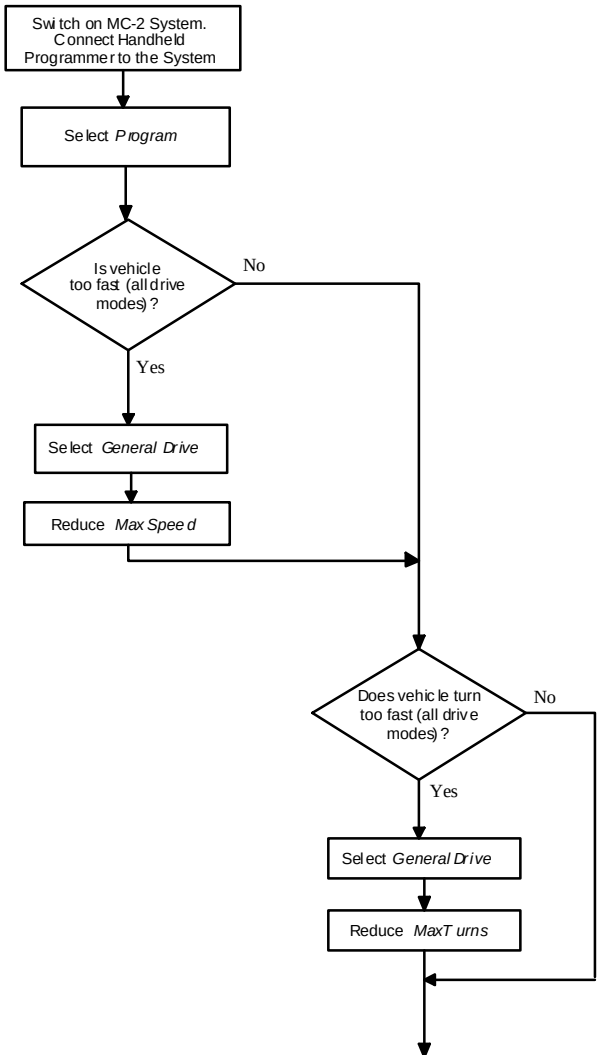
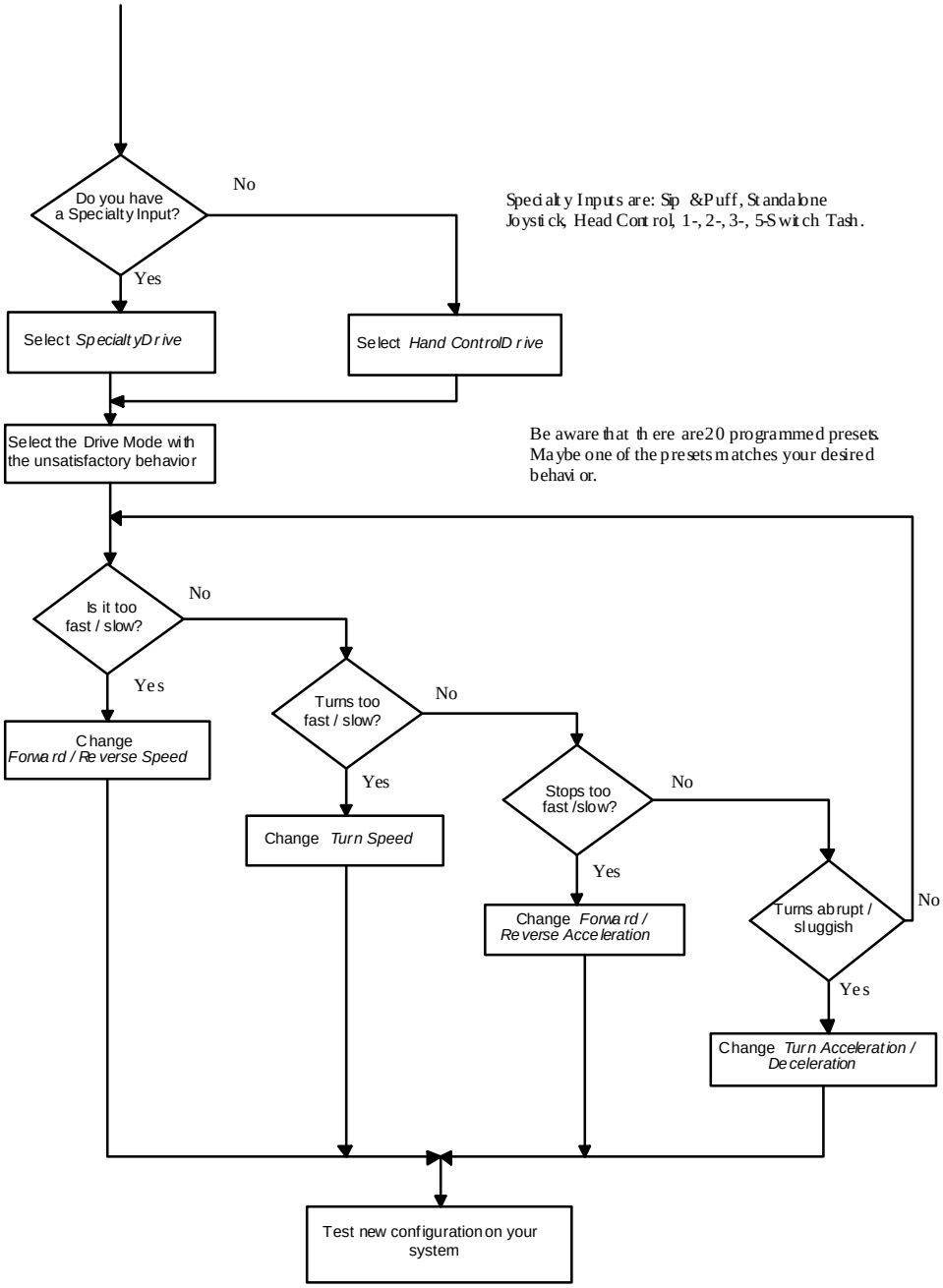


Fig. 54: *Drive response 1/2.*

Fig. 55: *Drive response 2/2.*



14 DIAGNOSTICS AND TROUBLESHOOTING

Overview

The MC-2 Generic System provides diagnostic information to assist dealers and service personnel in troubleshooting drive system problems. The diagnostics information can be obtained by observing the appropriate display (Hand Control LED status or LCD Display) or using the Handheld Programmer or PC Programming Station.

Fault Categories

Warning

A warning does not influence the system in its functionality, e.g., the system or a module still works without any restriction.

Examples:

- High pedal disable
- Limit switch reached

Error

An error directly influences the functionality of the system. A function of a device may be reduced until the error condition has been corrected. After correcting the problem, all functions are available again (without power cycling the system).

Examples:

- Invalid system configuration (e.g., two Specialty Input Devices)
- Brake released mechanically

Fault

A Fault means the breakdown of one or several functions of the system (e.g., all functions of a device are disabled). The concerned functions will no longer be available until the error condition has been corrected and, in addition, a power cycle has been performed. All functions of the system which are not affected by the error condition are still available to the user.

Examples:

- Battery completely discharged
- Motor not connected

Failure

A Failure is a fatal error condition. In the event of a system failure, the system reacts with an emergency shutdown. In the event of a device failure, the device reacts with an emergency shutdown.

Examples:

- Communication failure (device or cable broken)
- Software failure

Definition of System Responses

There are different system responses possible as a result of errors, faults, or failures.

Creep Drive

Creep Drive is initiated mainly as a response to operating conditions that are off-specifications, e.g., battery voltage outside the specified range or overheated motors or electronics. Speed and acceleration in Creep Drive can be programmed (see Parameters, Monitor Values, etc. / Programmable Parameters sections).

Direct PWM Drive

Due to a problem in the control loop, caused either by invalid current measurement results or non-plausible control loop parameters, the motors are driven but no longer controlled. This means that slopes and obstacles affect both driving speed and direction.

Emergency Stop

Dangerous situations like active 'Dead Man Switch Line,' broken bus cables, etc. result in an emergency stop of the vehicle. The deceleration rate of the emergency stop is programmable (see Parameters, Monitor Values, etc. / Programmable Parameters sections).

Park Brake Stop

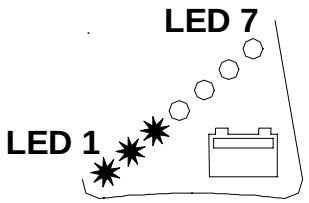
This is the most drastic way to stop a vehicle. Without using a ramp, the motors are immediately stopped, the brakes are engaged, and the main relay is switched off.

LED Diagnostics

The BDI LEDs of the Hand Control are also used to signal warning and fault conditions. As soon as at least one LED is **blinking**, an exceptional condition exists.

If more than one warning is present, the corresponding LEDs are flashing alternately.

Fig. 56: *Diagnostic with the BDI of the Hand Control.*



LEDs scroll up and down

Table 29: *Explanation of scrolling LEDs*

LED Display	Fault group	Possible ca
1 ... 4	Incorrect system configuration or charger connected	- Input dev - No outpu - Two inpu (Specialt - Tash inpu connected - Charger c
1 ... 7	HPD High Pedal Disable	Input devic switched on

LEDs flash twice per second for four seconds and horn sounds twice in quick succession. Pattern is repeated every minute.

Table 30: *Explanation of LEDs flashing twice a second*

LED Display	Fault group	Possible cause
1	Battery warning	Battery voltage too low or too high
1 - 2	Temperature warning	Controller or motors overheated
1 - 3	Controller warning	Motor control problem, possible failure in electronics
1 - 4	MFS switch disconnected	MFS switch required but not connected
1 - 5	Restricted Drive	Seat lockout restricts or disables driving
1 - 6	Input or Output Device warning	- Incompatible input or output device - Seat motors overload - Seat motors disconnected - Limit switches shorted or disconnected
1 - 7	Charger Disable	- Charger connected - Seat lockout switch disables driving when no seat module is used

LEDs flash four times per second and horn sounds twice a second. This pattern is continuously repeated.

Table 31: *Explanation of LEDs flashing four times a second*

LED Display	Fault group	Possible cause
1	Battery fault	Batteries completely discharged or overcharged
1 - 2	Right motor or brake fault	Right motor or brake unplugged, cable broken
1 - 3	Left motor or brake fault	Left motor or brake unplugged, cable broken
1 - 4	Input Device fault	- Joystick not centered for 5 seconds after power is switched on - Joystick not calibrated - Hand Control direction assignment invalid - Defective input device
1 - 5	Output Device fault	- Faulty connection to output device - Defective output device
1 - 6	Controller fault	Controller or general system failure
1 - 7	Communication fault	- Communication fault - Device not connected - Defective device

Programmer Diagnostics (on-line monitoring)

The Handheld Programmer and the PC Programming Station allow the MC-2 system to be monitored for uncorrected faults.

Faults are displayed in plain language.

Note that faults which have occurred, but have been corrected, are stored in the fault histories of each device (see ‘Maintenance / Device fault histories’ chapter).

To monitor the MC-2 system for uncorrected faults, connect either the Handheld Programmer or the PC Programmer to the MC-2 system (see Parameter, Monitor Value, etc.).

15 MAINTENANCE

Overview

There are no user-serviceable parts in the CURTIS MC-2 system. **No attempt should be made to open, repair, or otherwise modify any device of the MC-2 system**. Doing so may damage a device and will void the warranty.

It is recommended that all MC-2 devices be kept clean and dry and that the devices' diagnostic histories be checked periodically. Clearing the diagnostic histories is reserved to the OEM and is recommended after every repair of a device.

Cleaning

Periodically cleaning the devices' exteriors will help protect them against corrosion and possible electrical control problems caused by dirt, grime, and chemicals that are part of the operating environment and that normally exist in battery-powered systems.

When working around any battery-powered vehicle, proper safety precautions should be taken. These include, but are not limited to: proper training, wearing eye protection, and avoiding loose clothing and jewelry.

CAUTION

Use the following cleaning procedure for routine maintenance:

- Remove power by disconnecting the battery
- Remove any dirt or corrosion from the connector areas. Wipe clean the MC-2 devices with a moist rag. Dry device before reconnecting the battery. Do not subject the MC-2 devices to pressurized water flow from either a standard hose or a power washer.
- Make sure all connections are tight.

Diagnostic Histories

The Handheld Programmer can be used to access the MC-2 devices' diagnostic history file. The PC Programming Station can do the same but it also has one single diagnostic history file created for the entire MC-2 system (all device diagnostic history files concatenated).

The device diagnostic history files contain all the faults that the device has experienced since the last time the file was cleared.

With the Handheld Programmer, choose the menu item '*Faults / <device name> / Fault History*' to read the desired device diagnostic history file.

With the PC Programming Station, choose the '*Wheelchair System / Wheelchair Diagnostics / Fault History*' menu to access the complete MC-2 systems' diagnostic history file.

To view a single device's diagnostic history file, select the desired device from the PC Programming Stations' device tree and choose the pop-up menu *'Diagnostics / Fault History.'*

For details on this matter please consult the on-line help of the PC Programming Station.

After a problem has been diagnosed and corrected, it is a good idea to clear the device diagnostic history files. This allows the devices to accumulate new files. By checking the new files, you can readily determine whether the problem has indeed been completely fixed.

To clear a device diagnostic history file with the Handheld Programmer, choose the *'Faults / <desired device> / Clear Fault History'* menu.

To clear all the concatenated device diagnostic history files with the PC Programming Station, choose 'Clear' from the pop-up menu of the fault tree of the *'Device/System / Fault History.'* The same can be done for single device fault histories by choosing the *'Clear'* menu item that is available in the pop-up menu of a *'Diagnostics / Fault History.'*

Note that clearing device fault histories is reserved to the OEM level only.

GLOSSARY OF TERMS

AUX

Auxiliary: Auxiliary functions are used for the Seat Module and the ECU Module.

Bus

The physical medium used to interconnect all devices by means of a set of cables.

CAN

Controller Area Network. Serial multimaster communication protocol, specified in ISO/DSI 11898.

DMS Line

Dead Man Switch line is a safety feature. The DMS line disables any movement when no input command is present. It is part of the bus.

ECU

Environmental Control Unit

Headcontrol

An input device to control the system with head movements only. Only in combination with an LCD Display.

Input Device

A device that transforms user actions into internal messages (Hand Control, Headcontrol, etc.).

KEY Line

The KEY Line provides on/off switching of the entire system. It is part of the bus.

LCD Display

A feedback device, giving the user information in a readable form (text or icons).

MCP-Bus

A Curtis Bus including power, communication, and safety lines. The protocol is a Curtis CAN-based product.

MFS

Multi-Function Switch is a special switch used for Specialty Controls for stopping and menu handling.

OEM

Original Equipment Manufacturer

:

Parameters

Used to adjust a device (and therefore the system) to user and system needs.

Sip & Puff

An input device based on sip and puff commands to control the entire system. Only in combination with an LCD Display.

Specialty Input Devices

Sip & Puff, Headcontrol, Stand Alone Joystick, Tash

Stand Alone Joystick

A reduced Hand Control. Only the Joystick itself is present. Only in combination with an LCD Display.

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