

***CURTISS -  
WRIGHT***



**PG DRIVES TECHNOLOGY  
R-NET- TECHNICAL MANUAL  
SK77981/14**



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### **1 Electrical Specifications..... 205**



## ABOUT THIS MANUAL

The Technical Manual gives an introduction to the R-net Control System.

Throughout the manual icons are used to draw the reader's attention.

The icons used are:

**NOTE:** A general point for best practice.

**CAUTION:** A point of safety which if ignored could result in damage to the Control System or the vehicle.

**WARNING:** A point of safety which if ignored could cause injury to the individual.

Curtiss-Wright accepts no liability for any losses of any kind if the points are not followed.

## CHAPTER 1 - OPERATION

### 1 INTRODUCTION

The relevant contents of this chapter should be included in the wheelchair's operating guide. Further copies are available from Curtiss-Wright in either written or disk (Word) format. Copies should not be made without the express permission of Curtiss-Wright.

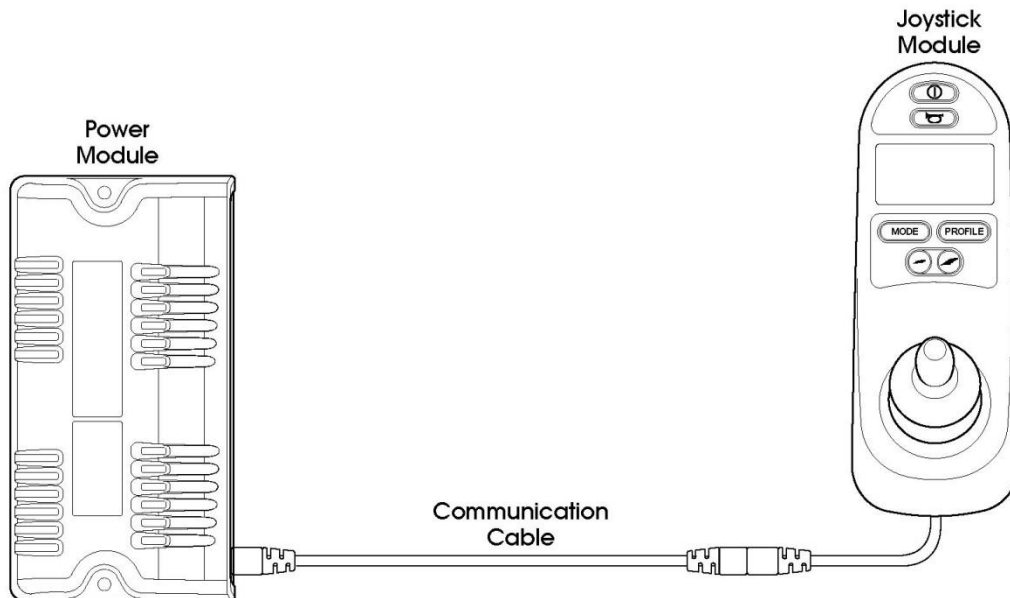
The operation of the R-net varies dependent on programming. This chapter covers all types of operation. It is the responsibility of the wheelchair manufacturer to ensure that only the relevant sections of this chapter are included in the wheelchair's operating manual.

The operation of the R-net wheelchair control system is simple and easy to understand. The control system incorporates state-of-the-art electronics, the result of many years of research, to provide you with ease of use and a very high level of safety. In common with other electronic equipment, correct handling and operation of the unit will ensure maximum reliability.

Please read this chapter carefully - it will help you to keep your wheelchair reliable and safe.

### 2 GENERAL

An R-net control system comprises a minimum of two modules - Joystick Module and Power Module. Because of the modular design, the depth of the control system can be greatly increased. The following diagram shows the basic set-up.



#### 2.1 HANDLING

Avoid knocking your control system and especially the joystick. Be careful not to strike obstacles with the control system or joystick when you drive. Never drop the control system.

When transporting your wheelchair, make sure that the control system is well protected. Avoid damage to cables.

## 2.2 OPERATING CONDITIONS

Your control system uses industrial-grade components throughout, ensuring reliable operation in a wide range of conditions. However, you will improve the reliability of the control system if you keep exposure to extreme conditions to a minimum.

Do not expose your control system or its components to damp for prolonged periods. If the control system becomes contaminated with food or drink clean it off as soon as possible.

## 2.3 CLEANING

Clean the control system and the joystick with a cloth dampened with diluted detergent. Be careful when cleaning the joystick and screen.

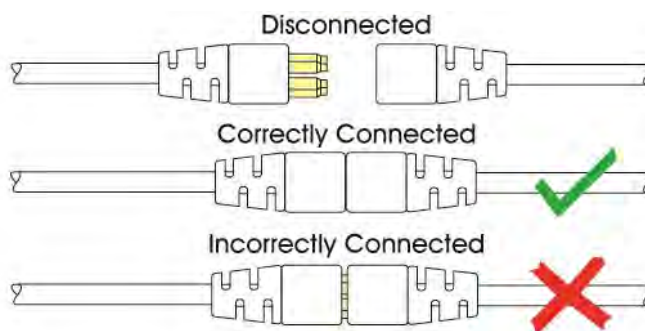
Never use abrasive or spirit-based cleaners.

## 3 MATING CONNECTORS

To connect the Communication Cables:

- Holding the connector housing, firmly push the connector into its mate until you can no longer see the yellow plastic.

The connectors are secured using a friction system.



To disconnect the Communication Cables:

- Holding the connector housing firmly, pull the connectors apart.

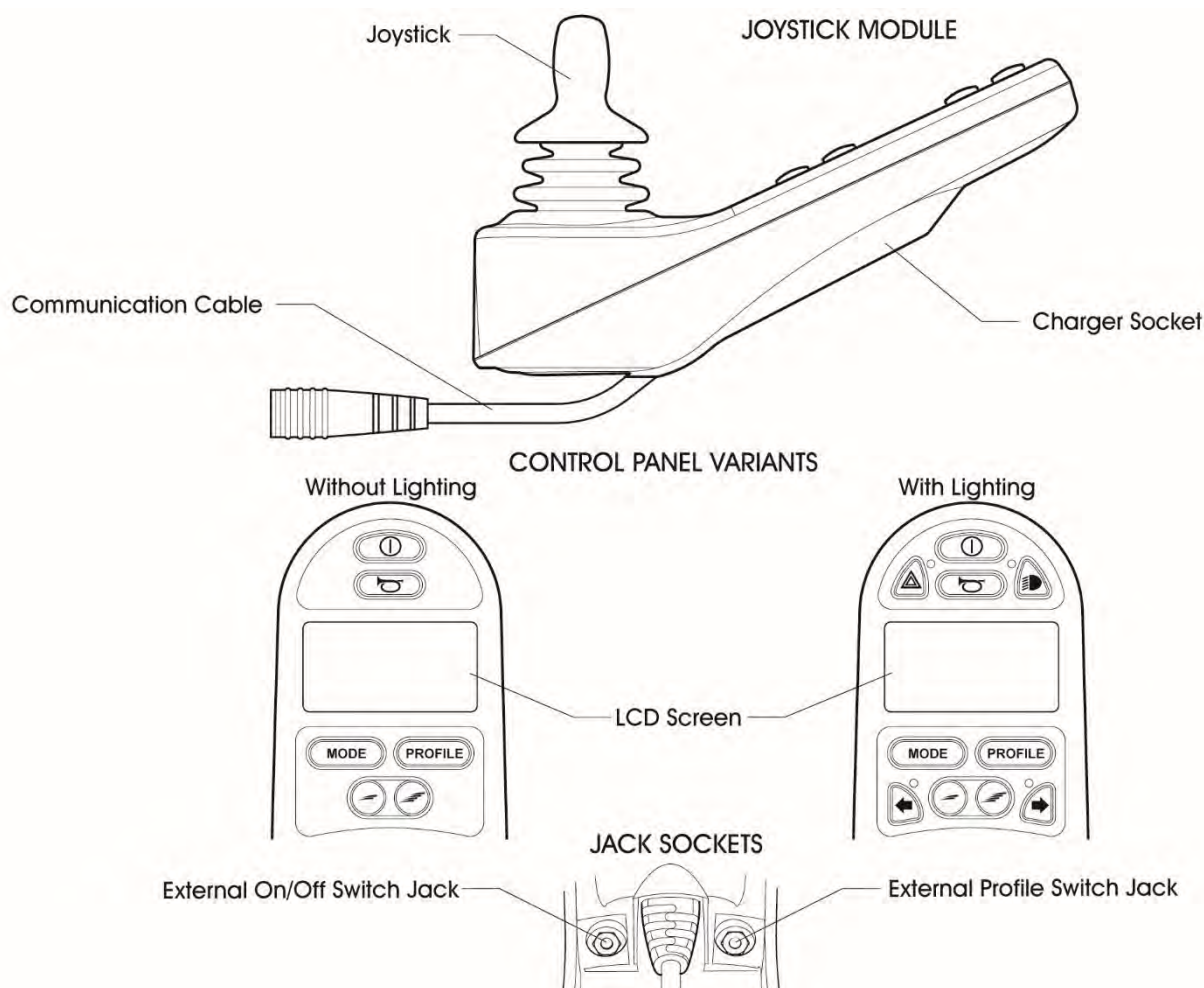
### NOTE:

**Do not hold or pull on the cable. Always grip the connector when connecting and disconnecting.**

When the control system is first switched on after a connection, or system component change the Timer will be displayed whilst the system checks itself and then the Re-start icon will be displayed. Switch the control system off and on again to operate.

## 4 CONTROLS

The R-net control system has two versions of Joystick Module – with and without lighting control. Most of the controls are common to both however, the lighting buttons are only included on the Joystick Module with lighting control. Each of the controls is explained within this section.

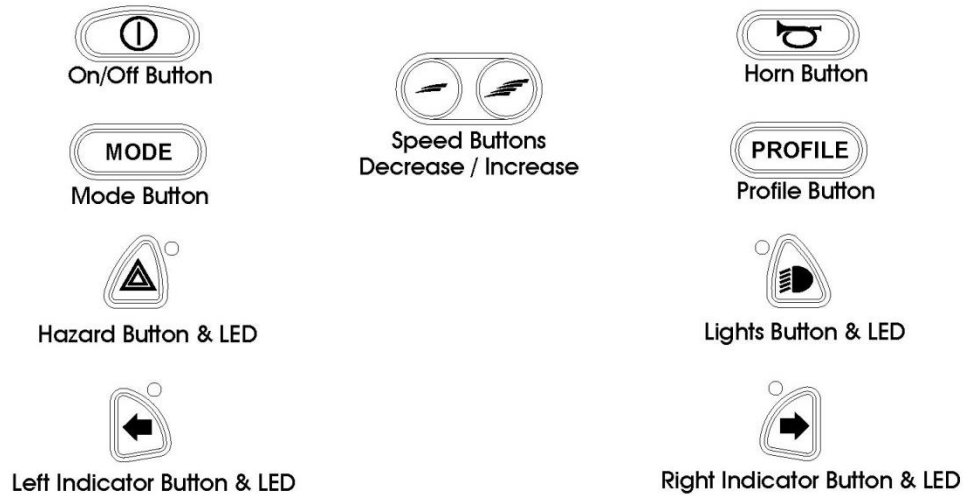


### 4.1 JOYSTICK

The primary function of the joystick is to control the speed and direction of the wheelchair. The further you push the joystick from the center position the faster the wheelchair will move. When you release the joystick the brakes are automatically applied.

If the wheelchair is fitted with actuators, the joystick can also be used to move and select actuators, refer to section 5.5 for more details.

## 4.2 BUTTONS



### 4.2.1 ON/OFF BUTTON

The On/Off button applies power to the control system electronics, which in turn supply power to the wheelchair's motors. Do not use the On/Off button to stop the wheelchair unless there is an emergency. (If you do, you may shorten the life of the wheelchair drive components).

### 4.2.2 HORN BUTTON

The Horn will sound while this button is depressed.

### 4.2.3 SPEED DECREASE BUTTON

This button decreases the maximum speed setting.

Depending on the way the control system has been programmed a momentary screen may be displayed when the button is pressed.

Refer to section 5 for details of the momentary screen.

Refer to Chapter 3 - Programming for details.

### 4.2.4 SPEED INCREASE BUTTON

This button increases the maximum speed setting.

Depending on the way the control system has been programmed a momentary screen may be displayed when the button is pressed.

Refer to section 5 for details of the momentary screen.

Refer to Chapter 3 - Programming for details.



#### 4.2.5 MODE BUTTON

The Mode button allows the user to navigate through the available operating Modes for the control system. The available modes are dependent on programming and the range of auxiliary output devices connected to the control system.

Refer to Chapter 3 - Programming for details.

#### 4.2.6 PROFILE BUTTON

The Profile button allows the user to navigate through the available Profiles for the control system. The number of available Profiles is dependent on how the control system is programmed.

Depending on the way the control system has been programmed a momentary screen may be displayed when the button is pressed.

Refer to section 5 for details of the momentary screen.

Refer to Chapter 3 - Programming for details.

#### 4.2.7 HAZARD WARNING BUTTON AND LED

This button activates and de-activates the wheelchair's hazard lights. Depress the button to turn the hazards on and depress the button again to turn them off.

When activated the hazard LED and the indicator LEDs will flash in sync with the wheelchair's indicators.

#### 4.2.8 LIGHTS BUTTON AND LED

This button activates and de-activates the wheelchair's lights. Depress the button to turn the lights on and depress the button again to turn them off.

When activated the lights LED will illuminate.

#### 4.2.9 LEFT INDICATOR BUTTON AND LED

This button activates and de-activates the wheelchair's left indicator. Depress the button to turn the indicator on and depress the button again to turn it off.

When activated the left indicator LED will flash in sync with the wheelchair's indicator(s).

#### 4.2.10 RIGHT INDICATOR BUTTON AND LED

This button activates and de-activates the wheelchair's right indicator. Depress the button to turn the indicator on and depress the button again to turn it off.

When activated the right indicator LED will flash in sync with the wheelchair's indicator(s).

#### 4.2.11 EXTERNAL ON/OFF SWITCH JACK

This allows the user to turn the control system on and off using an external device, such as a buddy button.



---

#### 4.2.12 EXTERNAL PROFILE SWITCH JACK

This allows the user to select Profiles using an external device, such as a buddy button.

To change the Profile whilst driving simply press the button.

If the control system is set to latched drive or actuator control operation, then the polarity of the jack input is reversed to effect a fail-safe system; meaning this input will provide an External Profile Switch function and an Emergency Stop Switch function.

##### NOTE:

**The Joystick Module is supplied with rubber bungs that must be inserted into the Jack Socket when no external device is connected.**

---

#### 4.3 LCD SCREEN

The status of the control system can be understood by observing the LCD screen. The control system is on when the screen is backlit.

Refer to section 5 for details on screen symbols.

---

#### 4.4 CHARGER SOCKET

This socket should only be used for charging or locking the wheelchair. Do not connect any type of programming cable into this socket.

Refer to section 13 for more details on charging.

This socket should not be used as a power supply for any other electrical device. Connection of other electrical devices may damage the control system or affect the E.M.C. performance of the wheelchair.

##### **WARNING:**

**The control system's warranty will be voided if any device other than a battery charger supplied, with the wheelchair, or the lock key is connected into this socket.**



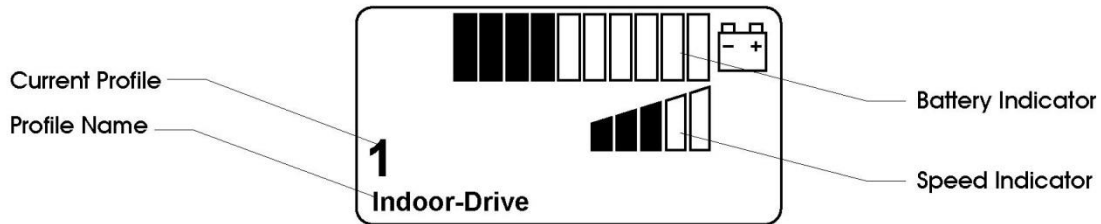


## 5 LCD SCREEN - MONOCHROME

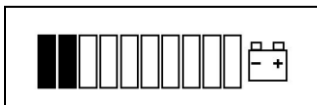
The status of the control system can be understood by observing the LCD screen.

### 5.1 SCREEN SYMBOLS

The Drive screen for the R-net has common components, which will always appear, and components that will only appear under certain conditions. Below is a view of a typical Drivescreen in Profile 1.



#### 5.1.1 BATTERY INDICATOR



This displays the charge available in the battery and can be used to alert the user to the status of the battery.

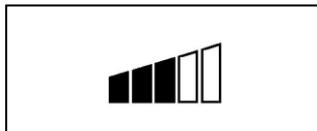
**Steady** This indicates that all is well.

**Flashing Slowly** The control system is functioning correctly, but you should charge the battery as soon as possible.

**Stepping Up** The wheelchair batteries are being charged. You will not be able to drive the wheelchair until the charger is disconnected and you have switched the control system off and on again.

Refer to section 12 for a description of how to read the Battery Gauge.

#### 5.1.2 SPEED INDICATOR



This displays the current speed setting.

The speed setting is adjusted using the Speed Buttons.

#### 5.1.3 CURRENT PROFILE



The Profile Number describes which Profile the control system is currently operating in.

The Profile Text is the name or description of the Profile the control system is currently operating in.

#### 5.1.4 IN FOCUS



When the control system contains more than one method of direct control, such as a secondary Joystick Module or a Dual Attendant Module, then the Module that has control of the wheelchair will display the In Focus symbol.

#### 5.1.5 SPEED LIMIT



If the speed of the wheelchair is being limited, for example by a raised seat, then this symbol will be displayed.

If the wheelchair is being inhibited from driving, then the symbol will flash.

#### 5.1.6 LATCHED



When the control system is operating in a latched condition this symbol will be displayed.

#### 5.1.7 RESTART



When the control system requires a reboot; for example, after a module re-configuration, this symbol will be flashed.

#### 5.1.8 FAULT



The control system can detect a wide variety of errors. When the system has detected an error that is not severe enough to cause the system to trip, then this symbol will be displayed.

#### 5.1.9 MOTOR TEMPERATURE



This symbol is displayed when the control system has intentionally reduced the power to the motors, in order to protect them against heat damage.

#### 5.1.10 CONTROL SYSTEM TEMPERATURE



This symbol is displayed when the control system has intentionally reduced its own power, in order to protect itself against heat damage.

### 5.1.11 TIMER



This symbol is displayed when the control system is changing between different states. An example would be entering into Programming Mode. The symbol is animated to show the sands falling.

### 5.1.12 E-STOP

**E-STOP**

If the control system is programmed for latched drive or actuator operation, then it is normal for an Emergency Stop Switch to be connected into the External Profile Switch Jack.

If the Emergency Stop Switch is operated or disconnected, this symbol will be displayed.

### 5.1.13 BLUETOOTH



When Bluetooth Mode is entered the screen will display the following icon.

## 5.2 MOMENTARY SCREENS

If the momentary screens are programmed to be displayed then pressing the Speed or Profile Buttons will display screens such as below.



Speed Momentary Screen

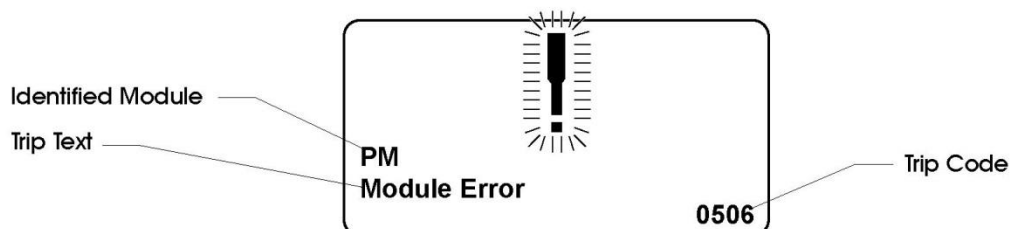
**Profile 2**  
Outdoor-Drive

Profile Momentary Screen

## 5.3 DIAGNOSTIC SCREEN

When the control system safety circuits have operated and the control system has been prevented from moving the wheelchair a diagnostics screen will be displayed.

This indicates a system trip, i.e. the R-net has detected a problem somewhere in the wheelchair's electrical system.



If the error is in a non-active module, for example in the ISM but with a drive Profile is selected, then drive will still be possible, however, the diagnostic screen will appear intermittently.



### 5.3.1 IDENTIFIED MODULE

This identifies which module of the control system has registered the problem, such as:

PM	Power Module
JSM	Joystick Module
ISM	Intelligent Seating/lighting Module

### 5.3.2 TRIP TEXT

The Trip Text gives a brief description of the trip type.

### 5.3.3 TRIP CODE

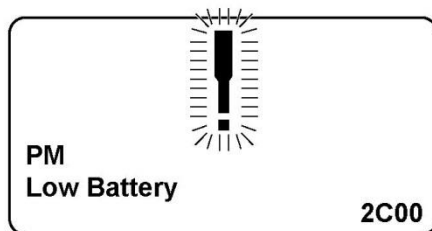
The 4 digit code displayed gives the exact trip that has been recorded.

### 5.3.4 DIAGNOSTIC PROCEDURE

Please follow this procedure:

- Read and note the Trip Text displayed, the identified Module and the Trip Code.
- Switch off the control system.
- Make sure that all connectors on the listed Module and the wheelchair are mated securely.
- Check the condition of the battery.
- Note the Trip Text description, and take the required action.
- Switch on the control system again and try to drive the wheelchair. If the safety circuits operate again, switch off and do not try to use the wheelchair. Contact your service agent.

Example:



Identified Module	<b>Power Module</b>
Trip Text	<b>Low Battery</b>
Trip Code	<b>2C00</b>

This means the battery needs charging or there is a bad connection to the battery.

- Check the connections to the battery. If the connections are good, try charging the battery.

## 5.4 LOCKING THE CONTROL SYSTEM

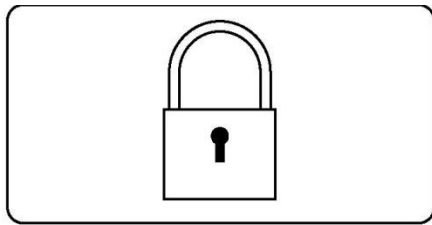
The Control System can be locked in one of two ways. Either using a button sequence on the keypad or with a physical Key. How the Control System is locked depends on how the wheelchair manufacturer has programmed the system.

### 5.4.1 KEYPAD LOCKING

To lock the wheelchair using the keypad;

- While the control system is switched on, depress and hold the On/Off button.
- After 1 second the control system will beep. Now release the On/Off button
- Deflect the joystick forwards until the control system beeps.
- Deflect the joystick in reverse until the control system beeps.
- Release the joystick, there will be a long beep.
- The wheelchair is now locked.

The following screen will be displayed, the next time the Control System is switched on.



If an LED Joystick Module is fitted the Speed Indicator LEDs will ripple from left to right. Refer to Chapter 4.

To unlock the wheelchair:

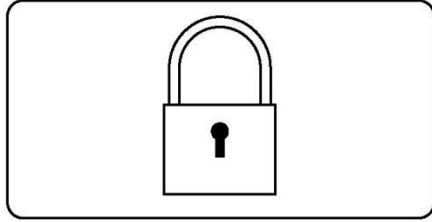
- If the control system has switched off, press the On/Off button.
- Deflect the joystick forwards until the control system beeps.
- Deflect the joystick in reverse until the control system beeps.
- Release the joystick, there will be a long beep.
- The wheelchair is now unlocked.

### 5.4.2 KEY LOCKING

To lock the wheelchair with a key;

- With the Control System switched on, insert and remove a Curtiss-Wright supplied key into the Charger Socket on the Joystick Module. A short beep will be heard.
- The wheelchair is now locked.

The following screen will be displayed, the next time the Control System is switched on.



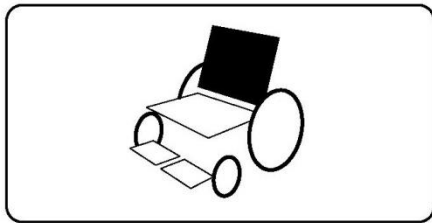
To unlock the wheelchair;

- If the control system has switched off, press the On/Off button.
- Insert and remove a Curtiss-Wright supplied key into the Charger Socket on the Joystick Module. A short beep will be heard.
- The wheelchair is now unlocked.

## 5.5 ACTUATOR SELECTION SCREEN

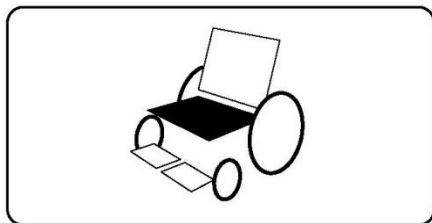
To adjust the seat position the actuator screen must be visible.

Depress the Mode Button to scroll through the Mode screens until you reach the actuator screen, displayed below.



Actuator adjustment is achieved as follows.

- Move the Joystick sideways to select the desired axis.  
(This is indicated by the section of the wheelchair that is highlighted)
- Move the joystick forwards and backwards to move the actuator.



- Repeat these steps for each actuator that requires adjustment.

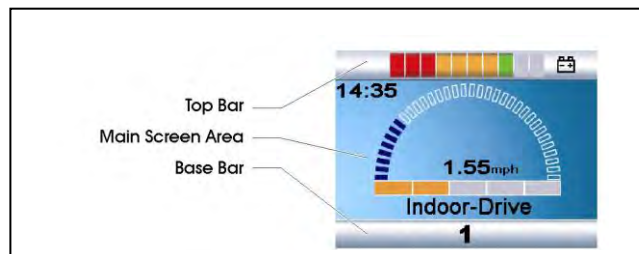
To drive again depress the Mode button until the Drive screen is reached or, in the case of the LED joystick module, until the Speed Indicator returns to its normal state.



## 6 LCD SCREEN - COLOR

This section covers those Joystick Modules that are fitted with a color LCD screen.

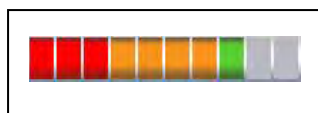
The color LCD screen is split into 3 areas of information. The Top Bar, the Base Bar and the Main Screen Area.



Each area is covered separately within this section.

### 6.1 TOP BAR

#### 6.1.1 BATTERY INDICATOR



This displays the charge available in the battery and can be used to alert the user to the status of the battery.

**Steady:** This indicates that all is well.

**Flashing Slowly:** The control system is functioning correctly, but you should charge the battery as soon as possible.

**Stepping Up:** The wheelchair batteries are being charged. You will not be able to drive the wheelchair until the charger is disconnected and you have switched the control system off and on again.

Refer to section 12 for a description of how to read the Battery Gauge.

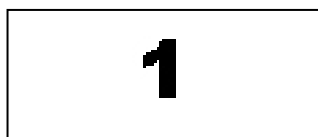
#### 6.1.2 FOCUS



When the control system contains more than one method of direct control, such as a secondary Joystick Module or a Dual Attendant Module, then the Module that has control of the wheelchair will display the In Focus symbol.

### 6.2 BASE BAR

#### 6.2.1 CURRENT PROFILE



The currently selected Profile is shown in numeric form.



### 6.2.2 MOTOR TEMPERATURE



This symbol is displayed when the control system has intentionally reduced the power to the motors, in order to protect them against heat damage.

### 6.2.3 CONTROL SYSTEM TEMPERATURE



This symbol is displayed when the control system has intentionally reduced its own power, in order to protect itself against heat damage.

## 6.3 MAIN SCREEN AREA

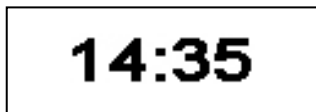
Drive Screen

### 6.3.1 PROFILE NAME



This is a text string that displays the name of the currently selected Profile. The name is programmable. Refer to the programming section for details.

### 6.3.2 CLOCK



This displays the current time in a numeric format.

The clock is user adjustable. Adjustable options are:

- Visibility, whether the clock is displayed on screen.
- The display format, 12 or 24 hour.
- The time, the user can adjust the time.

These adjustments are made within the Settings Menu. Refer to section 8 for details.

### 6.3.3 SPEED DISPLAY



This gives a proportional display of the wheelchairs speed. The Arc begins at 0% and has a programmable maximum. The programmable parameter is Max Displayed Speed. Refer to the Programming Chapter.



### 6.3.4 MAXIMUM SPEED INDICATOR



This displays the current maximum speed setting.

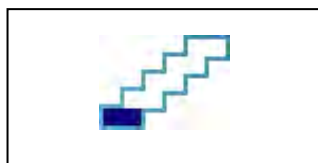
### 6.3.5 DIGITAL SPEED DISPLAY



This displays the actual speed of the wheelchair derived from the motors. The display can be set to mph or km/h.

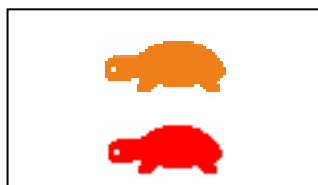
These adjustments can be made in the OBP Menu.

### 6.3.6 LATCHED



When the control system is operating in a latched condition this symbol will be displayed.

### 6.3.7 INHIBIT



If the speed of the wheelchair is being limited; for example, by a raised seat, then this orange symbol will be displayed.

If the wheelchair is being inhibited from driving, then this red symbol will be flashing.

Mode Screens

### 6.3.8 ACTUATOR MODE



Displays the sections of the chair currently selected for movement, the name given to the selection and a direction arrow showing what sort of movement is available.

### 6.3.9 BLUETOOTH MODE



When Bluetooth Mode is entered the following screen will be displayed.

## 6.4 MESSAGE WINDOW



The R-net displays warning icons and informational messages, in a dedicated message window.

### 6.4.1 RESTART



When the control system requires a reboot; for example, after a module re-configuration, this symbol will be flashed.

### 6.4.2 TIMER



This symbol is displayed when the control system is changing between different states. An example would be entering into Programming Mode. The symbol is animated to show the sands falling.

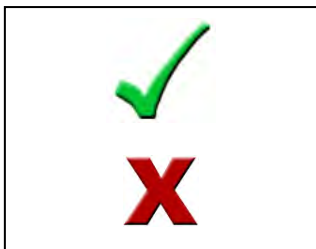
### 6.4.3 SLEEP



This symbol will be displayed for a short time before the R-net enters into a sleep state.

### 6.4.4 CROSS & TICK

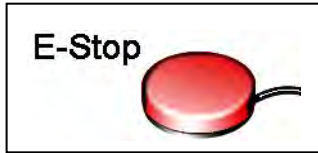
These symbols will be displayed during configuration procedures.



Process completed correctly.

Process not completed correctly.

#### 6.4.5 E-STOP



If the External Profile Switch is activated during drive, or actuator operation, this symbol will be displayed.

#### 6.4.6 JOYSTICK DISPLACED



If you operate the Joystick before or just after you switch the control system on, the screen will flash the joystick displaced screen.

You must release and center the Joystick to resume normal operation. If you do not release the Joystick within five seconds the wheelchair will not be able to move, even if you release the Joystick and operate it again. The screen will display a diagnostic screen at this time. You can reset this condition by switching the control system off and on again.

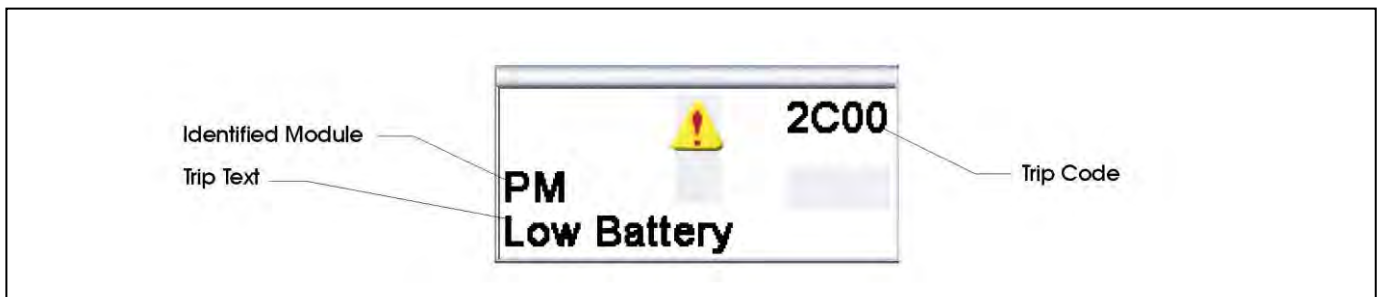
#### 6.4.7 CONTROL SYSTEM LOCKED



The Control System can be locked in one of two ways. Either using a sequence of deflections and presses with a Joystick or with a physical Key. How the Control System is locked depends on how the wheelchair manufacturer has programmed it.

Refer to Section 5 for a detailed description of the Locking and Unlocking procedures.

#### 6.4.8 DIAGNOSTIC SCREEN



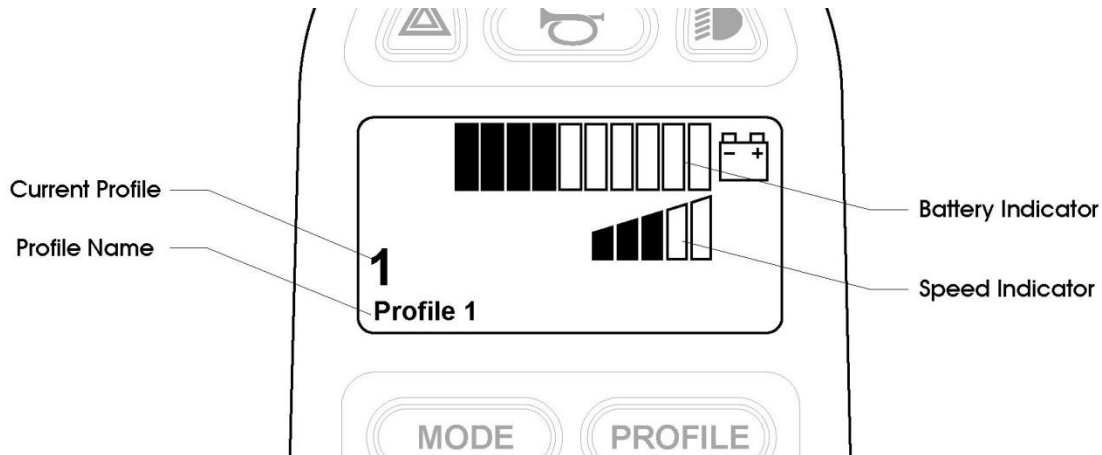
When the control system safety circuits have operated and the control system has been prevented from moving the wheelchair a diagnostics screen will be displayed.

This indicates a system trip, i.e. the R-net has detected a problem somewhere in the wheelchair's electrical system.

Refer to section 5 for a detailed description of Diagnostic screen and procedure. Refer to Chapter 5 Diagnostics for a complete description of the Trip Texts.

## 7 GETTING READY TO DRIVE

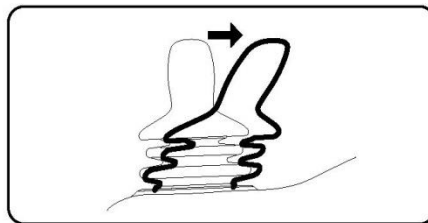
- Operate the On/Off switch. The screen will go through an initializing process then show the base screen as follows. In the case on an LED Joystick Module the battery gauge will illuminate.



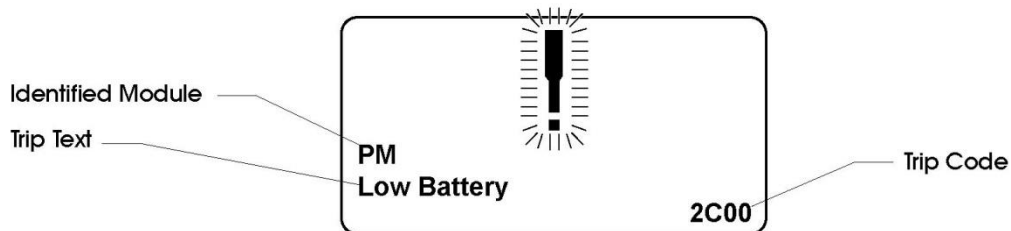
- Check that the Speed Setting is at a level that suits you.
- Push the joystick to control the speed and direction of the wheelchair.

### NOTE:

If you push the joystick before or just after you switch the control system on, the screen will flash the joystick displaced screen. You must release and center the joystick to resume normal operation. If you do not release the joystick within five seconds the wheelchair will not be able to move, even if you release the joystick and push it again. The screen will display the diagnostic screen at this time. You can reset this condition by switching the control system off and on again.



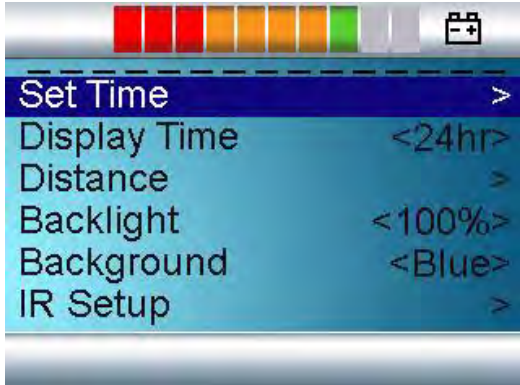
If you do not push the joystick as you switch the wheelchair on and the diagnostic screen is displayed, as in the following diagram, then the R-net has detected a problem somewhere in the wheelchair's electrical system.





## 8 SETTINGS MENU

The Settings Menu allows the user to adjust the CISM display in terms of clock adjustment and display format, the brightness of the backlight, the background color and the behavior of the odometer. The menu is accessed by depressing the Speed Down and Speed Up buttons simultaneously. A typical Settings Menu display would be as below.



Each of the menu items are described in the following sections.

### 8.1 SET TIME

A right joystick deflection will enter a clock adjustment screen in which further joystick deflections are used to set the time.

### 8.2 DISPLAY TIME

This sets the format of the time display or turns it off.

The options are 12hr, 24hr or Off. Left and right joystick deflections are used to change between the options.

### 8.3 DISTANCE

This sets the functionality of the odometer and a screen as below will appear.



Total Distance	This is a value held in the Power Module and relates to the total distance driven using that Power Module.
Trip Distance	This is a value held in the CISM and relates to the total distance driven since the last reset.
Display Distance	Sets whether Total Distance or Trip Distance appears as the odometer display on the CISM.



Clear Trip Distance	A right joystick deflection will clear the Trip Distance value.
Exit	A right joystick deflection will return to the Settings Menu.

---

## 8.4 BACKLIGHT

This sets the intensity of the LCD backlight.

The adjustable range is 0% to 100% in steps of 10%. Adjustments are made with left and right joystick deflections.

---

## 8.5 BACKGROUND

This sets the color of the screen background. Blue is the standard, but in very bright sunlight then a white background will make the display more visible.

The options are Blue, White and Auto. Left and right joystick deflections are used to change between the options.

Blue means the background will be blue in all Profiles.

White means the background will be white in all Profiles.

Auto means the color will be set by the programmable parameter, Background, which can be set to be different across the Profiles. For example, blue for the slower Profiles that are for indoor use and white for the faster Profiles intended for outdoor use. For more details of the parameter, Background, refer to the relevant section in the Programming chapter.

---

## 8.6 IR SETUP

IR Set up allows the user access the Omni IR (Infra Red) menus. For full details on how to learn, delete and use the IR functions available please refer to the R-net Omni Technical Manual SK78813.

---

## 8.7 EXIT

Exits the Settings Menu back to normal operation.

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# 9 TIPS FOR USING YOUR CONTROL SYSTEM

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## 9.1 DRIVING - GENERAL

Make sure that the control system is mounted securely and that the joystick position is correct. The hand or limb you use to operate the joystick should be supported, for example by the wheelchair arm pad. Do not use the joystick as the sole support for your hand or limb - wheelchair movements and bumps could upset your control.

---

## 9.2 DRIVING TECHNIQUE

The control system interprets your joystick movements and produces appropriate movements of your wheelchair. You will need very little concentration to control the wheelchair, which is especially useful if you are inexperienced. One popular technique is to simply point the joystick in the direction you want to go. The wheelchair will “home-in” on the direction you push the joystick.

The further you push the joystick away from the rest position, the faster the wheelchair will go. Releasing the joystick will stop the wheelchair.



The intelligent speed control system minimizes the effects of slopes and different types of terrain.

**WARNING:**

**The wheelchair user must be capable of driving a wheelchair safely. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

### 9.3 SLOW OR SLUGGISH MOVEMENT

If the wheelchair does not travel at full speed or does not respond quickly enough, and the battery condition is good, check the maximum speed setting. If adjusting the speed setting does not remedy the problem then there may be a non-hazardous fault. Contact your service agent.

## 10 PRECAUTIONS FOR USE

**NOTE:**

**In the event of the wheelchair moving in an unexpected way RELEASE THE JOYSTICK. This action will stop the wheelchair under any circumstances.**

### 10.1 HAZARDS

Do not drive the wheelchair:

- Beyond restrictions indicated in your wheelchair user manual, for example maximum inclines, curb height etc.
- In places or on surfaces where a loss of wheel grip could be hazardous, for example on wet grassy slopes.
- If you know that the control system or other crucial components require repair.

**WARNING:**

**Although the R-net control system is designed to be extremely reliable and each unit is rigorously tested during manufacture, the possibility of a system malfunction always exists (however small the probability). Under some conditions of system malfunction the control system must (for safety reasons) stop the chair instantaneously. If there is any possibility of the user falling out of the chair as a result of a sudden braking action, it is imperative that a restraining device such as a seat belt is supplied with the wheelchair and that it is in use at all times when the wheelchair is in motion. Curtiss-Wright accepts no liability for losses of any kind arising from the unexpected stopping of the wheelchair, or arising from the improper use of the wheelchair or control system.**

**Do not operate the control system if the chair behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the control system off at once and consult your service agent. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

**Electronic equipment can be affected by Electro Magnetic Interference (EMI). Such interference may be generated by radio stations, TV stations, other radio transmitters and cellular phones. If the chair exhibits erratic behavior due to EMI, turn the control system off immediately and consult your service agent. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**



It is the responsibility of the chair manufacturer to ensure that the wheelchair complies with appropriate National and International EMC legislation. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The wheelchair user must comply with all wheelchair safety warnings. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

## 11 SAFETY CHECKS

The electronic circuits in your control system have been designed to be extremely safe and reliable. The on-board microcomputer carries out safety checks at up to 100 times per second. To supplement this safety monitoring you should carry out the following periodic checks.

If the control system fails any of these checks, do not use the wheelchair and contact your service agent.

### 11.1 DAILY CHECKS

**Joystick:** With the control system switched off, check that the joystick is not bent or damaged and that it returns to the center when you push and release it. If there is a problem do not continue with the safety checks and contact your service agent.

### 11.2 WEEKLY CHECKS

**Parking brake:** This test should be carried out on a level floor with at least one meter clear space around the wheelchair.

Switch on the control system.

Check that the screen remains on after initialization and that the battery gauge is displaying a reasonable amount of charge.

Push the joystick slowly forwards until you hear the parking brakes operate. The chair may start to move.

Immediately release the joystick. You must be able to hear each parking brake operate within a few seconds.

Repeat the test a further three times, pushing the joystick slowly backwards, left and right.

**Connectors:** Make sure that all connectors are securely mated.

**Cables:** Check the condition of all cables and connectors for damage.

**Joystick gaiter:** Check the thin rubber gaiter or boot, around the base of the joystick's shaft, for damage or splitting, check visually only, do not handle the gaiter.

**Mounting:** Make sure that all the components of the control system are securely mounted. Do not overtighten any securing screws.

### 11.3 SERVICING

To ensure continued satisfactory service, we suggest you have your wheelchair and control system inspected by your service agent after a period of 1 year from commencement of service. Contact your service agent for details when the inspection is due.





## 12 BATTERY GAUGE

The battery gauge is included to let you know how much charge is left in your batteries. The best way for you to use the gauge is to learn how it behaves as you drive the wheelchair. Like the fuel gauge in a car, it is not completely accurate, but it will help you avoid running out of “fuel”.

The battery gauge works in the following way:

When you switch on the control system, the battery gauge shows an estimate of the remaining battery charge.

The battery gauge gives you a more accurate reading about a minute after you start driving the wheelchair.

### NOTE:

**When you replace worn out batteries, fit the type recommended by the wheelchair manufacturer. If you use another type the battery gauge may be inaccurate.**

The amount of charge in your batteries depends on a number of factors, including the way you use your wheelchair, the temperature of the batteries, their age and the way they are made. These factors will affect the distance you can travel in your wheelchair. All wheelchair batteries will gradually lose their capacity as they age.

The most important factor that reduces the life of your batteries is the amount of charge you take from the batteries before you recharge them. Battery life is also reduced by the number of times you charge and discharge the batteries.

To make your batteries last longer, do not allow them to become completely flat. Always recharge your batteries promptly after they are discharged.

If your battery gauge reading seems to fall more quickly than usual, your batteries may be worn out.

### 12.1 HOW TO READ A BATTERY GAUGE

If the battery gauge shows red, yellow and green, the batteries are charged. (Bars 1 – 10)

If the battery gauge shows just red and yellow, then you should charge the batteries as soon as you can. (Bars 1 – 7)

If the battery gauge shows just red, either steady or flashing slowly, then you should charge the batteries immediately. (Bars 1 – 3)

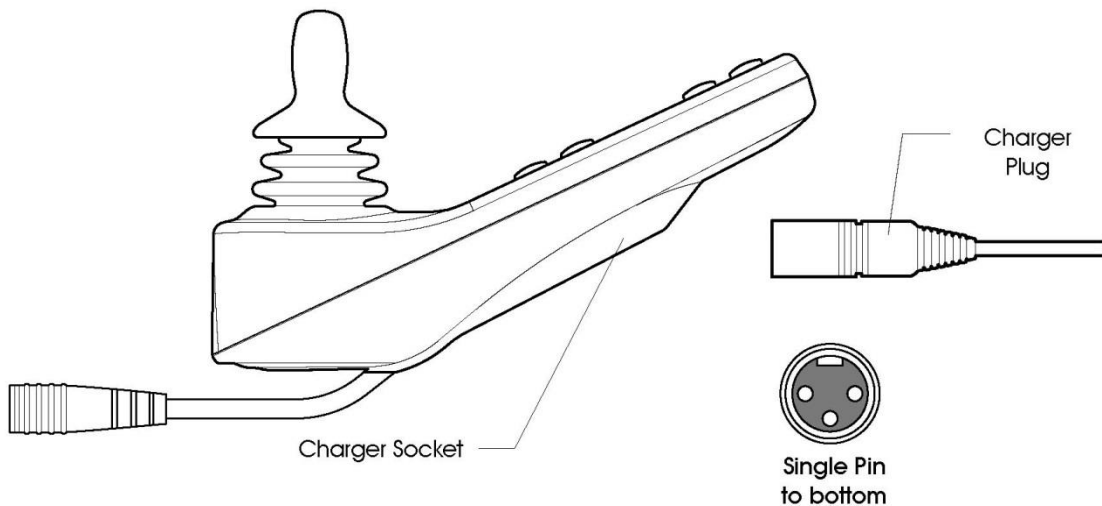
### WARNING:

**Do not operate the control system if the battery is nearly discharged. Failure to comply with this condition may leave the user stranded in an unsafe position, such as in the middle of a road. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

## 13 BATTERY CHARGING

To charge the wheelchair batteries connect the charger plug into the battery charger socket on the R-net JSM. You will not be able to drive the wheelchair when the charger is connected.

To connect the charger plug, ensure the single pin is at the bottom, as shown in the following illustration, then offer the charger plug to the R-net in a horizontal orientation. The molded guide on the R-net will help you to locate the plug. Ensure the plug is pushed fully in position.



### **WARNING:**

Do not exceed the maximum charging current of 12Arms. Always use an off-board charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the charger plugs. This presents a potential burn hazard for the user. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the control system's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Only use the battery charger that has been supplied with your wheelchair. The use of incorrect chargers could damage the batteries, wheelchair, control system or charger itself, or may result in parts overheating creating the potential for burns or even fire. Curtiss-Wright accepts no liability for losses of any kind if the charger is incompatible with the control system (see Chapter 2, section 7) or any other part of the wheelchair system.



## 14 PROGRAMMING

The control system can be programmed to meet your needs. Programming can be performed using the OBP (On-board Programming) feature or the specialist R-net software and Dongle or the Diagnostic Test Tool (DTT).

If you re-program your control system, make sure that you observe any restrictions given in your wheelchair user manual. Note any changes you make for future reference.

### **WARNING:**

**Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Curtiss-Wright accepts no liability for losses of any kind if the programming of the control system is altered from factory preset values.**

## 15 SERVICING

All repairs and servicing must be carried out by authorized service personnel. Opening or making any unauthorized adjustments or modifications to the control system or its components will invalidate any warranty and may result in hazards to yourself or other people, and is strictly forbidden.

### **WARNING:**

**Curtiss-Wright accepts no liability for losses of any kind arising from unauthorized opening, adjustment or modifications to the R-net control system.**

**If the control system is damaged in any way, or if internal damage may have occurred through impact or dropping, have the product checked by qualified personnel before operating. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

## 16 WARRANTY

The R-net control system is covered by a warranty period defined by the wheelchair manufacturer. For details of the warranty period, please contact your service agent.

The warranty will be void if the R-net control system has:

- Not been used in accordance with the R-net control system Technical Manual, SK77981.
- Been subject to misuse or abuse.
- Been modified or repaired by non-authorized persons.

### **WARNING:**

**The warranty will be void if the R-net has not been used in accordance with Technical Manual SK77981, the R-net has been subject to misuse or abuse, or if the R-net has been modified or repaired by unauthorized persons.**

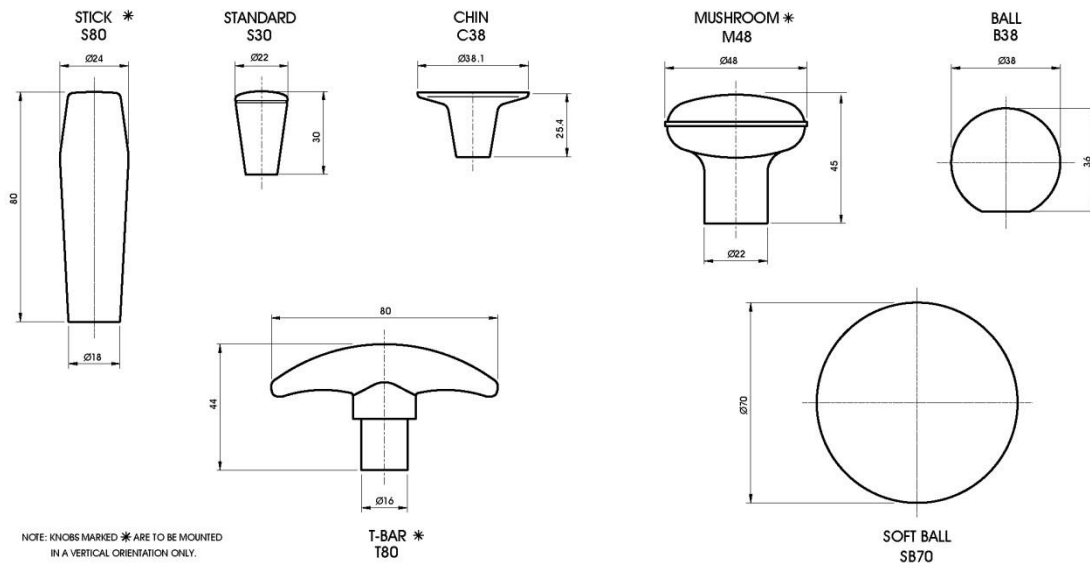


## 17 JOYSTICK KNOBS

The knob fitted to your joystick is suitable for most applications. If you would prefer another type, there is a range of alternatives available. Please contact your wheelchair distributor or manufacturer for advice. Do not replace the joystick knob with any unauthorized item - it may cause hazardous operation.

### **WARNING:**

**Do not replace the joystick knob with any unauthorized item. It may cause hazardous operation. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**





## CHAPTER 2 - INSTALLATION

### 1 DOCUMENTATION

#### 1.1 R-NET OPERATION

Study Chapter 1. It is important that the operation information in Chapter 1 is supplied with the wheelchair, either as part of the wheelchair user handbook or as a separate document.

This Chapter sets out the installation conditions that must be complied with in order to meet the safety requirements of TÜV (Germany), ISO7176-14 and EN12184.

#### 1.2 PROGRAM SETTINGS

The R-net control system is supplied with preset settings that are chosen with the wheelchair manufacturer to ensure safe operation and compliance with relevant legal requirements, over the whole of the operating range of the wheelchair.

**WARNING:**

**It is the manufacturer's responsibility to program the control system to suit the vehicle model and ensure safe operation in compliance with relevant legal requirements over the whole of the operating range. Curtiss-Wright accepts no liability for losses of any kind due to failure to, or incorrect programming of the R-net Control System. Refer to Chapter 3 for programming details.**

The wheelchair must stop within the maximum distance specified for the country in which the wheelchair will be used. TÜV Product Service (Germany) specify the distance to be as stated in EN12184.

If users with particular disabilities need very low braking rates and this results in a longer stopping distance, the maximum speed must be re-programmed so that the stopping distance requirement is satisfied.

State in the wheelchair user handbook that it is the responsibility of the person programming the control system to make sure that the stopping distance requirement is satisfied. If the braking rate is low, the forward and reverse maximum speed settings may need to be re-programmed. To assist the person in this task, include a graph in the wheelchair user handbook showing the relationship between the maximum forward/reverse speed settings and the forward/reverse braking rate which is required to ensure the correct stopping distance.

It may be possible to program settings which compromise the stability of the wheelchair. Perform suitable tests to establish which programming restrictions are needed to prevent instability. State any programming restrictions in the wheelchair user handbook.

State in the wheelchair user handbook that it is the responsibility of the person programming the control system to make sure that the settings are safe and to note any programming changes that they make.

**WARNING:**

**Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic control systems. Incorrect programming could result in an unsafe setup of a wheelchair for the user. Curtiss-Wright accepts no liability for losses of any kind if the programming of the control system is altered from factory pre-set values. Curtiss-**



Wright accepts no liability for losses of any kind if the drive or stability characteristics of the chair are altered without prior notification and discussion with Curtiss-Wright.

**NOTE:**

It is possible for wheelchair manufacturers to limit the values of speeds and accelerations that can be programmed in the field. This facility ensures a safe-operating envelope for the wheelchair can be maintained.

### 1.3 SOFT-STOP

The R-net has a programmable value called Soft Stop Rate that sets the emergency stopping distance. You must ensure that the emergency stopping distance is within the distances specified for the country in which the wheelchair will be used. TÜV Product Services (Germany) specify the distance to be as stated in EN12184.

### 1.4 OTHER INFORMATION

You must provide a diagram in the wheelchair user handbook showing the user controls and the main features of the control system.

In addition, you should include a brief specification of operating supply voltage range and operating temperature range.

## 2 IMMOBILIZING THE WHEELCHAIR

### 2.1 PREVENTION OF UNAUTHORIZED USE

TÜV requires that the wheelchair must have a means of preventing unauthorized use. This can be implemented as detailed in Chapter 1 section 5.4.

### 2.2 CHARGER INTERLOCK

ISO 7176-14 requires you to provide a means of preventing the use of the wheelchair while the batteries are being charged. The charger socket and on-board charger connection fitted to Curtiss-Wright R-net control systems include an inhibit facility. Refer to section 6.5.

Contact Curtiss-Wright if you need advice.

**WARNING:**

**The chair manufacturer is responsible for providing a means of preventing the use of the wheelchair while the batteries are being charged. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

### 2.3 POWER DOWN

The control system can be programmed to power down if the joystick is not operated over a set period of time. Refer to Chapter 3 for programming details.

To restart, switch the control system on.

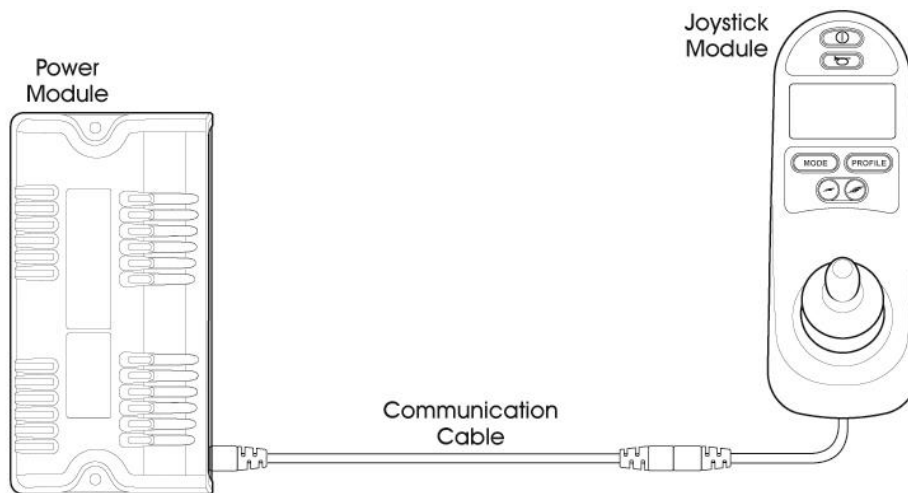
### 3 CONNECTIONS

The following is a selection of the most common configurations.

#### 3.1 CONTROL CONFIGURATIONS

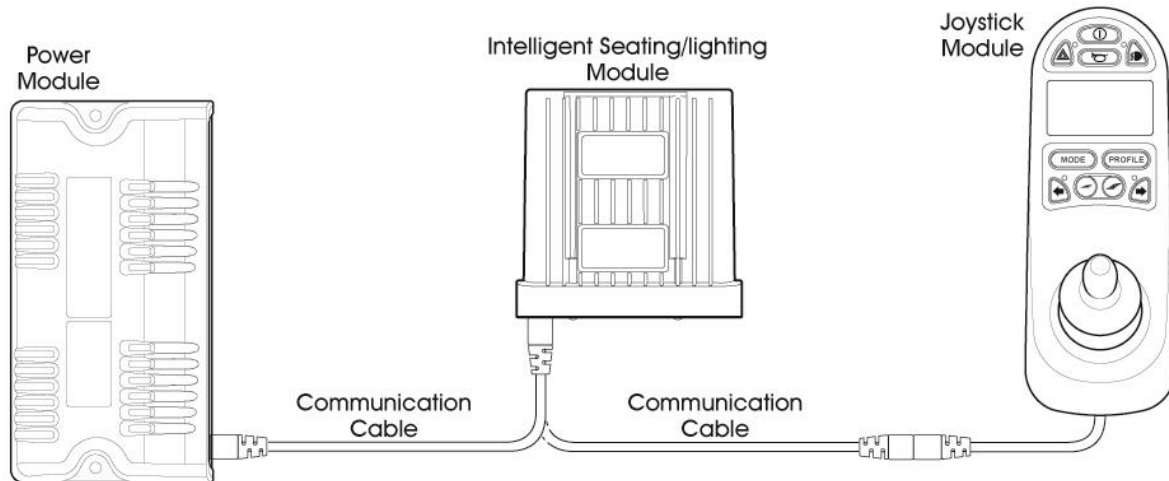
##### 3.1.1 BASIC CONFIGURATION

Consists of a Power Module, a Communication Cable and a Joystick Module.



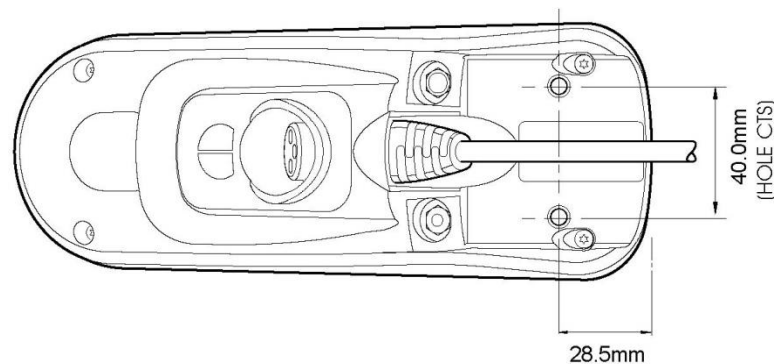
##### 3.1.2 JOYSTICK & ISM CONFIGURATION

Consists of a Power Module, an Intelligent Seating/Lighting Module (ISM), 2 Communication Cables and a Joystick Module.



## 4 MOUNTING

### 4.1 JOYSTICK MODULE MOUNTING



#### 4.1.1 GENERAL

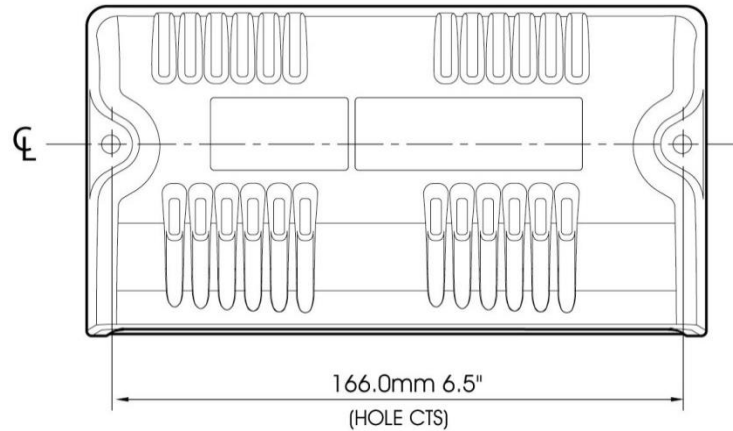
The Joystick Module should be secured using two M5 screws with a maximum penetration of 12mm. Be careful not to overtighten the screws. See data sheet for further information.

#### 4.1.2 ORIENTATION

The Joystick Module must be mounted with the joystick shaft pointing vertically upwards. If you want to use any other mounting alternatives then contact Curtiss-Wright.

### 4.2 POWER MODULE MOUNTING





#### 4.2.1 GENERAL

Fix the Power Module to the wheelchair chassis using suitable M5 or equivalent hardware.

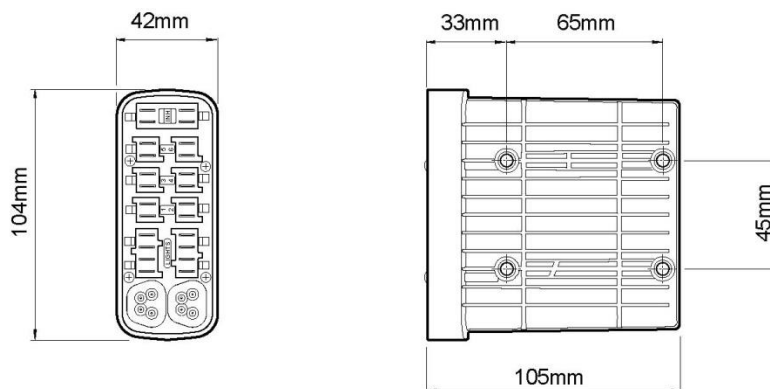
#### 4.2.2 ORIENTATION

The function of the Power Module is not sensitive to mounting orientation; however, it should be mounted in such a way that water cannot enter and remain in the connector recesses. It is recommended that the unit is not mounted with the connectors uppermost. The Power Module has an IPX4 moisture resistance rating.

#### 4.2.3 POSITION

The Power Module must be mounted in a position where it is not exposed to conditions of water or dust above those specified in ISO7176/9. The Power Module is designed to withstand levels of shock and vibration experienced when mounted to the chassis of a wheelchair. Direct impacts onto the unit should be avoided.

#### 4.3 ISM MOUNTING



### 4.3.1 GENERAL

The ISM should be secured using four M5 screws with a maximum penetration of 7mm. Be careful not to over tighten the screws. See data sheet for further information.

### 4.3.2 ORIENTATION

The function of the ISM is not sensitive to mounting orientation; however, it should be mounted in such a way that water cannot enter and remain in the connector recesses. It is recommended that the unit is not mounted with the connectors uppermost. The ISM has an IPX4 moisture resistance rating.

### 4.3.3 POSITION

The ISM must be mounted in a position where it is not exposed to conditions of water or dust above those specified in ISO 7176/9. The ISM is designed to withstand levels of shock and vibration experienced when mounted to the chassis of a wheelchair. Direct impacts onto the unit should be avoided.

## 4.4 CABLES

The cables to the ISM must be routed and secured in such a way as to prevent damage to them, for example by cutting or crushing. Contact Curtiss-Wright if you need further advice.

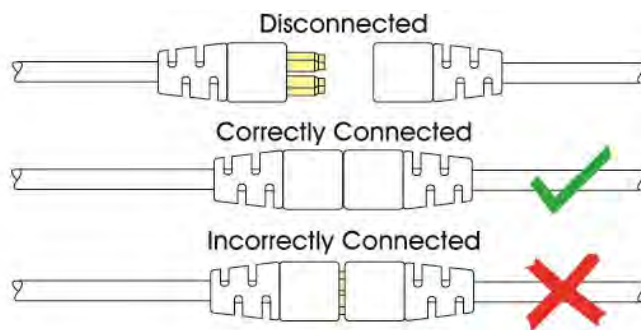
## 5 JOYSTICK MODULE WIRING

The Joystick Module is connected to the Power Module with a Communication Cable.

To connect the Communication Cables:

- Holding the connector housing, firmly push the connector into its mate until you can no longer see the yellow plastic.

The connectors are secured using a friction system.



To disconnect the Communication Cables:

- Holding the connector housing firmly, pull the connectors apart.

#### NOTE:

**Do not hold or pull on the cable. Always grip the connector when connecting and disconnecting.**

**CAUTION:**

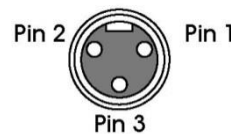
When the control system is first switched on after a connection, or system component change the Timer will be displayed whilst the system checks itself and then the Re-start icon will be displayed. Switch the control system off and on again to operate.

Route and secure the cable in such a way as to prevent damage, for example by crushing or cutting.

## 5.1 CHARGER CONNECTOR

An Off-Board Charger can be connected to the Joystick Module's charger connector. The charger connector is Neutrik 3 pin type NC3FPP or equivalent, and the maximum charging current is 12A rms. Only chargers fitted with Neutrik NC3MX plugs should be connected into the Joystick Module. The pin connections of the charging socket are as below.

Pin	Connection
1	Battery Positive
2	Battery Negative
3	Inhibit

**NOTE:**

The maximum permissible charging current is 12Arms.

## 6 POWER MODULE & ISM WIRING

### 6.1 GENERAL

Study the data sheets for the Power Module and the ISM to identify:

- The output current, ratings and restrictions.
- The connector pin assignments.

Recommendations for the cross-sectional area, ratings and materials for wiring are given in the table in section 6.2. These depend on the application. You are responsible for establishing the suitability of the particular wiring arrangement used on the wheelchair. Curtiss-Wright can make general recommendations for wiring to R-net control systems, but Curtiss-Wright accepts no responsibility for the wiring arrangement used.

Make sure that the connectors you use are reliable under all operating conditions and correctly wired with no short circuits. Do not use unsuitable components - it may result in poor wheelchair reliability.

**WARNING:**

The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair, for both normal use and stalled conditions. Curtiss-Wright can make general recommendations for wiring for R-net control systems, but Curtiss-Wright accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used.



The chair manufacturer is responsible for ensuring that only the mating connectors specified by Curtiss-Wright on the control system's specific data sheet are used to connect to the control system. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the chair wiring system and that the workmanship associated with the wiring system is of a good enough quality. Failure to meet this condition could result in intermittent operation, sudden stopping or veering, or even create a burn or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

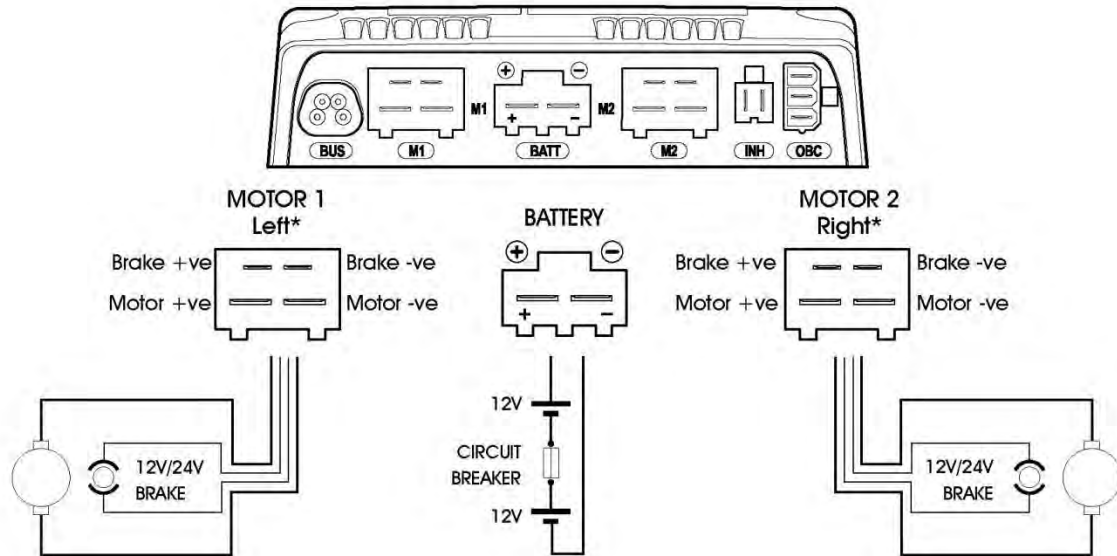
The power connectors for the R-net Power Module are specially designed by Curtiss-Wright for wheelchair applications. The crimps are standard AMP Timer parts but the plastic housings are custom. These connectors can be purchased from Curtiss-Wright or from Greenstock directly. Greenstock will also provide a pre-assembled cable service. Contact details for Greenstock are as follows: Greenstock Tel: +44 (0) 0845 2570444      [www.greenstock.co.uk](http://www.greenstock.co.uk)

The connector part numbers are as shown in the following table:

Connector	Curtiss-Wright Reference:	Greenstock Reference:
Battery (Up to 6mm <sup>2</sup> )	D49712 PG80-B	IPG-5202
Motor/Brake (Up to 4mm <sup>2</sup> )	D49713 PG80-M	IPG-5401
Battery (Up to 10mm <sup>2</sup> )	D50287 PG80-B-HP	IPG-5205-PS
Motor/Brake (Up to 10mm <sup>2</sup> )	D50947 PG80-M-HP	IPG-5405-PS
OBC	D50752 PG-OBC	IPG-7301-PS
Inhibit	D50753 PG-Inhibit	IPG-8201-PS
Actuator	D50754 PG-Actuator	IPG-8202-PS
Lighting (both sides)	D50784 PG-Lights	IPG-9401-PS

### 6.1.1 POWER MODULE WIRING

The following diagram gives details of the Power Module connections.

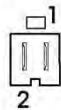


\* Assumes no Motor Swap programming has been undertaken

Joystick Movement	M1		M 2		Actual Movement	
	Motor +ve	Motor -ve	Motor +ve	Motor -ve		
Forward	+ve	-ve	+ve	-ve	Forward	**
Backward	-ve	+ve	-ve	+ve	Backward	**

\*\* Assumes no Joystick Orientation, Invert M1 Direction or Invert M2 Direction programming has been undertaken

#### INHIBIT 2



INH-2	Function
1	0V
2	Inhibit 2

#### ON-BOARD CHARGER

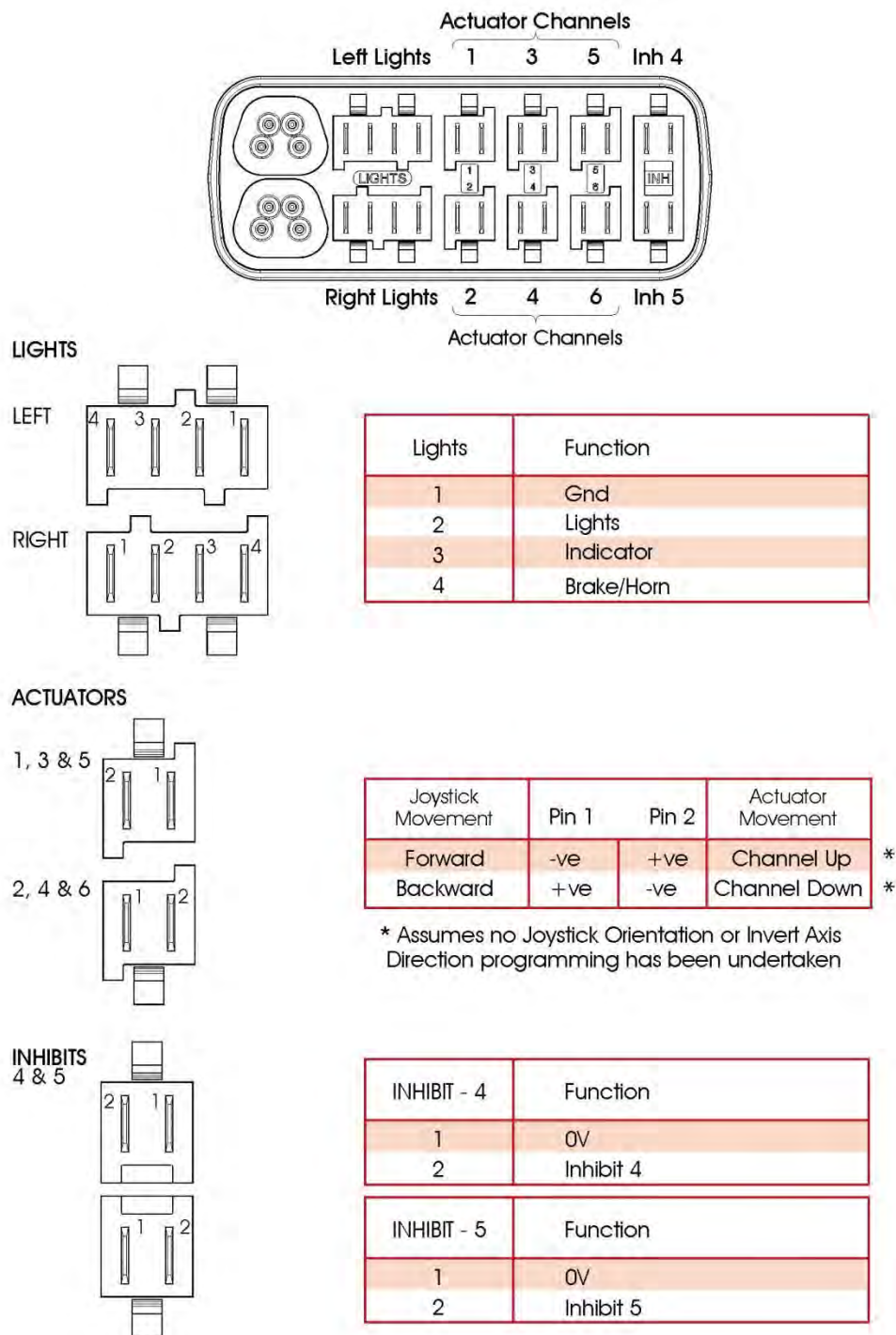


OBC	Function
1	Battery +ve
2	Inhibit 3
3	0V

The Power Module is shipped with rubber bungs inserted into some of the connectors. Only remove the rubber bung from the required connectors.

### 6.1.2 ISM WIRING

The following diagram gives details of the ISM connections.



The ISM is shipped with rubber bungs inserted into some of the connectors.  
Only remove the rubber bung from the required connectors.

### 6.1.3 CRIMPING



Good quality crimping is essential in ensuring the long term reliability of the wheelchair's electrical system. Poor quality crimps may initially appear to be satisfactory but, over time, they may cause problems. It is recommended that crimp quality is maintained by implementing the procedures detailed in IEC-60352-2 1990.

**WARNING:**

**Defective or poor quality crimps may affect the warranty of the control system. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

Hand tools for crimping and extraction are available from Greenstock. The references are as below.

**Battery, Motor and Brake wiring**

Small crimp tool handle (up to 6.0mm <sup>2</sup> ):	ICT-29020
Large crimp tool handle (up to 6.0mm <sup>2</sup> ):	ICT-29030
Die set for 0.5-1.5mm <sup>2</sup> wire:	ICD-29468
Die set for 2.5-4.0mm <sup>2</sup> wire:	ICD-29465
Die set for 4.0-6.0mm <sup>2</sup> wire:	ICD-29467
Crimp tool including die set (8-10.0mm <sup>2</sup> ):	AMP Part No. 734533-1
Extraction tool for 0.5-1.5mm <sup>2</sup> :	IET-503
Extraction tool for 2.5-10.0mm <sup>2</sup> :	IET-552

**OBC, Inhibit, Actuator and Lighting wiring**

Small crimp tool handle (up to 6.0mm <sup>2</sup> ):	ICT-29020
Die set for 0.5-1.5mm <sup>2</sup> wire:	ICD-29468
Extraction tool for 0.5-1.5mm <sup>2</sup> :	IET-503

**NOTE:**

**Only use the exact tools as specified.**

For details of automatic crimp tools contact Greenstock.

## 6.2 WIRE GAUGE AND TYPES

The table below gives the minimum recommended wire sizes for various R-net Power Module and ISM specifications.

Power Module	Battery	Motor	Brakes	Actuators *	Lighting	Inhibit
60A	6.0mm <sup>2</sup>	4.0mm <sup>2</sup>	0.5mm <sup>2</sup>	1.5mm <sup>2</sup>	0.5mm <sup>2</sup>	0.5mm <sup>2</sup>
80/90A	6.0mm <sup>2</sup>	4.0mm <sup>2</sup>	0.5mm <sup>2</sup>	1.5mm <sup>2</sup>	0.5mm <sup>2</sup>	0.5mm <sup>2</sup>
120A	8.0mm <sup>2</sup>	8.0mm <sup>2</sup>	0.5mm <sup>2</sup>	1.5mm <sup>2</sup>	0.5mm <sup>2</sup>	0.5mm <sup>2</sup>

These recommendations are for cable lengths of less than 1000mm. They are derived from well proven field experience of various international wheelchair manufacturers.

**NOTE:**

If 0.22mm<sup>2</sup> wire gauge is used for the Inhibit connections, the correct crimp is Tyco part 928990-1.

- \*If lower current limits are programmed for a particular ISM channel(s), it is possible to use smaller gauge wire. The following recommendations are made.

Maximum Up/Down Current Limit	Minimum Wire Size
3A	0.5mm <sup>2</sup>
5A	0.8mm <sup>2</sup>
10A	1.0mm <sup>2</sup>

**NOTE:**

Battery and motor wires should have 105°C rated PVC insulation.

**WARNING:**

The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair. Curtiss-Wright can make general recommendations for wiring for R-net control systems, but Curtiss-Wright accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used.

## 6.3 BATTERY CONNECTIONS

The control system incorporates sophisticated current limiting circuitry as protection for the circuits in the control system.

ISO 7176-14 requires you to provide protection against short circuits in the battery wiring and the power loom or the extremely unlikely event of a short circuit in the control system.

Place a suitable circuit breaker in series with the battery supply, for example in the link between two 12V batteries. If your batteries are held in separate enclosures, you must provide a circuit breaker with each of them.

The rating of the circuit breaker must match the capacity of the wiring specified in section 6.2. The following table gives some recommendations for circuit breaker selection. These recommendations are derived from well proven field experience of various international wheelchair manufacturers. Nevertheless, manufacturers must confirm these recommendations by carrying out suitable tests.

Power Module	Circuit Breaker Value
60A	50A
80/90A	90A
120A	90A

ISO 7176-14 states that the minimum operating time for the circuit breaker when the wheelchair is stalled is 15 seconds.



**WARNING:**

The chair manufacturer must install a suitable circuit breaker to provide protection against short circuits in the battery wiring, power loom or the control system. Failure to comply with this could result in a fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

## 6.4 MOTOR CONNECTIONS

If a circuit breaker is fitted in series with a motor, it is essential that the wheelchair assume a safe condition the moment the circuit breaker operates. You must therefore fit a circuit breaker with an auxiliary switch that disconnects the solenoid brake from the Power Module.

## 6.5 INHIBIT CONNECTIONS

The Power Module contains the Inhibit 2 and 3 connections, and the ISM contains the Inhibit 4 and 5 connections. These connections can be used to limit speed, inhibit drive and/or inhibit actuator channels. Refer to Chapter 3 – Programming for full details.

## 6.6 LIGHTING CONNECTIONS

Each lighting output is rated at 21W maximum. Use suitably rated wire to each bulb. The output is self-protecting against wiring and bulb faults and will shut-off if the maximum power rating is exceeded. Likewise, if the output becomes too hot it will shut-off to prevent permanent damage to itself.

## 6.7 INDICATOR CONNECTIONS

Each indicator output is rated at 42W maximum. Use suitably rated wire to each bulb. The outputs are self-protecting against wiring and bulb faults and will shut-off if the maximum power rating is exceeded. Likewise, if either output becomes too hot it will shut-off to prevent permanent damage to itself.

If an indicator bulb fails, the ISM will detect this and flash the remaining bulb for that side at 3Hz as well as sending information to the Joystick Module so that the relevant indicator LED flashes likewise.

## 6.8 ACTUATOR CONNECTIONS

Each actuator channel is rated at 15A maximum, although only 12A is available when the channel is programmed to 100% speed. If currents of greater than 12A are required, the programmed speeds for that channel must be reduced. The level of reduction is dependent upon the electrical characteristics of the actuator motor, so an empirical process to establish the level of the reduction is required.

If the wheelchair is fitted with solid mechanical end-stops at the end of the actuator travel, it is not necessary to fit limit switches as the ISM can detect when the actuator motor has stopped and will cut off the power to it.

## 6.9 ON-BOARD CHARGER CONNECTIONS

The Battery +ve and 0V connections are rated at 12A rms. Use suitably rated wire for these connections.

**NOTE:**

**The maximum permissible charging current is 12A rms.**



## 7 BATTERIES

The control system is designed for operation with 24V lead acid batteries. The batteries may be wet or gel electrolyte types. Contact the manufacturers for advice on battery selection.

### 7.1 BATTERY CHARGING

The R-net system can support two methods of charging, Off-Board and On-Board.

An On-Board Charger should be connected to the Power Module via the OBC connector, refer to the wiring diagram of the Power Module for pin details and to the section On-Board Charger Connections for details of maximum current.

An Off-Board Charger can be connected through a Charger Socket found on either a Joystick Module or the Omni. The charging socket is Neutrik 3 pin type NC3FPP or equivalent, and the maximum charging current is 12Arms. Only chargers fitted with Neutrik NC3MX plugs should be connected into the Joystick Module.

#### CAUTION:

**The maximum permissible charging current for both methods is 12A rms.**

To prevent the wheelchair from driving whilst the charger is connected, pin 3 must be linked to pin 2 inside the charger's plug.

#### WARNING:

**Do not exceed the maximum charging current of 12A rms. Always use an Off-Board Charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the charger plugs. This presents a potential burn hazard for the user. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

**Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the control system's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

**Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

**Examine all electrical appliances intended for use with the wheelchair, including the battery charger, regularly for damage, especially the cord, plug and enclosure. If the appliance is damaged, it must not be used until it has been repaired. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

## 8 DRIVE MOTORS

The control system is designed to be connected to permanent magnet DC motors, fitted with suitable gearboxes and solenoid brakes.

In order to optimize the performance of the wheelchair, the control system must be matched to the motor terminal impedance. This matching is implemented by programming the control system. The parameter for adjustment is Compensation. Refer to Chapter 3.



The Compensation values should be set in accordance with the armature resistance of the motor and all cables and connectors between the R-net and the motor.

**WARNING:**

The chair manufacturer is responsible for ensuring that the control system is matched to the motor resistance. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for always ensuring that any replacement motors or gearboxes are fully compatible with the originals that the control system was designed to match. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Users must not move a control system from one chair type to install it on a different chair type. Control systems with different part numbers may have both hardware and software differences to ensure that they are compatible with the electrical and dynamic characteristics of their specific target vehicles. The characteristics of one type of control system may not be compatible with a different, unauthorized chair. Failure to observe this warning could result in an unsafe setup for the wheelchair user and may create a fire hazard depending on the motors, wiring, connectors and circuit breakers installed on the unauthorized chair. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

## 9 SOLENOID BRAKES

The solenoid brakes can be either 12V or 24V. However, the control system must be programmed for the correct voltage. Refer to data sheet for the programming details of the control system. Refer to chapter 3 for information on programming.

If the current to either brake is less than 200 $\mu$ A or greater than 1A, a brake fault will be detected.

**WARNING:**

It is essential that the control system is programmed for the correct brake voltage. If it is not, damage may occur to the brakes or the drive performance of the wheelchair may be affected.

## 10 PROGRAMMER CONNECTION

### 10.1 OBP PROGRAMMING

On-Board Programming (OBP) allows the wheelchair to be programmed, via the Joystick Module, to suit an individual user.

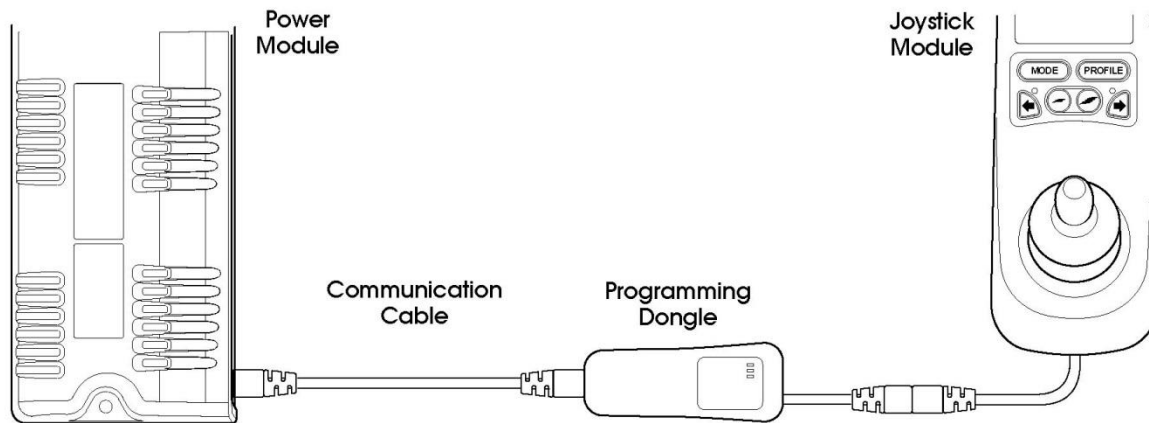
OBP can be entered via two methods – connection of a hardware dongle or a keycode. The actual method required is set by the factory programming of the control system.

**NOTE:**

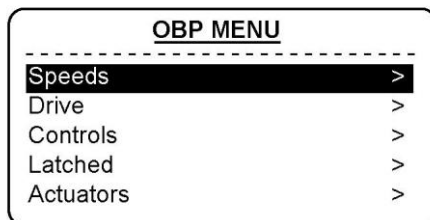
**OBP is not possible using an LED Joystick Module.**

If the hardware dongle method is set, then a Curtiss-Wright OBP Dongle needs to be connected to allow access to OBP. To use the dongle, follow the sequence below:

- Turn off the control system.
- Insert the R-net Dongle along the communication cables in the system configuration.



- Turn on the control system
- After initialization press the Mode key until the OBP screen is reached. See following diagram.



- After initialization OBP will be automatically entered.

If the keycode method is set, then the following button sequence will allow entry to OBP. Note, a dongle will also allow OBP access if this method is set.

- Hold down the Horn button and then hold down the On/Off button until there is a short bleep. Note, the normal power-up sound will occur prior to this bleep.
- Release the Horn button, but continue to hold down the On/Off button until there are two further short bleeps.
- Release the On/Off button, there will now be a longer bleep and OBP mode will be entered. See previous diagram.

#### WARNING:

If the keycode method is set, then it may be possible for a wheelchair user to gain entry to the OBP function. Curtiss-Wright accepts no liability for losses of any kind if this method of OBP is set. Curtiss-Wright also accepts no liability for losses of any kind if OBP access is gained by unauthorised personnel obtaining a dongle.

### 10.1.1 NAVIGATING THE OBP SCREENS

Whilst in OBP deflecting the joystick to the left, whilst the parameter title is highlighted, will display an elongated version of the parameter name.

There are two basic forms of display screen – one which shows global parameters and one which shows parameters which are profile dependent, i.e. can have different values in each of the drive profiles.

Example of a global parameter screen:

Global Controls	
Steer Correct	0
Sounder Volume	5
Endstop Bleep	no
Act. Entry Axis	1
Chge Prf in Drv	yes

Forward joystick deflections will select the parameter above.

Reverse joystick deflections will select the parameter below.

Left joystick deflections will take you to the previous screen.

Right joystick deflections will have no effect.

Example of a profiled parameter screen:

FWD	Pr1	Pr2	Pr3	Pr4
Acc▲	30	35	40	45
Acc▼	20	20	20	20
Dec▲	40	40	45	50
Dec▼	30	30	30	30
Spd▲	70	80	90	100
Spd▼	20	25	30	20

Forward joystick deflections will select the parameter above.

Reverse joystick deflections will select the parameter below.

The first left joystick deflection will display the parameter name in full.

The second left joystick deflection will take you to the previous screen.

Right joystick deflections will select the parameter to the right, if available.

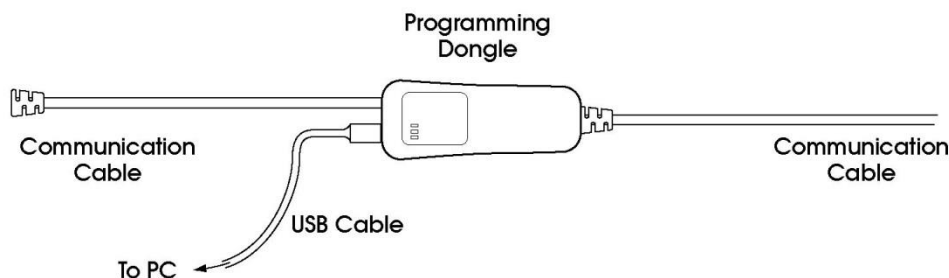
### 10.1.2 MAKING AN ADJUSTMENT

Once the parameter for adjustment has been selected, the Speed buttons can be used to make adjustments.

To ensure all new values are stored correctly, exit OBP mode with a series of left hand joystick deflections

## 10.2 PC PROGRAMMING

To utilize the R-net PC Programming Suite the R-net Dongle must first be connected in the communications system as shown in section 10.1. A USB cable can then be connected between the Dongle and a PC with the R-Net PC Programmer installed. For further details on programming refer to Chapter 3.





### 10.3 DTT PROGRAMMING

The Curtiss-Wright Diagnostic Test Tool may be used to program the Control System. To utilize a DTT:

- Switch off the Control System.
- Insert DTT into the communications system using the R-net Cable supplied.
- Switch on the Control System.

For detailed information about the DTT refer to the Diagnostic Test Tool Technical Manual SK79393.

## 11 PRODUCTION TESTS

- Perform the following tests, in order, on each wheelchair before dispatch.

These tests should be conducted in an open space and a restraining device such as a seat belt should always be used. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

### 11.1 MOUNTING

- Make sure that all the control system is securely mounted. Do not over-tighten any securing screws.

### 11.2 CABLES AND CONNECTORS

- Check all cables and connectors for damage. Make sure that all connectors are securely mated.

### 11.3 JOYSTICK AND GAITER

- Check that the joystick is not bent or damaged.
- Check the thin rubber gaiter or boot, around the base of the joystick shaft, for damage or splitting. Check visually only, do not handle the gaiter.
- Check that the joystick returns to the center position when you push and release it.

### 11.4 PRESET SETTINGS

- Make sure that the control system is using the correct settings. Refer to the Chapter 3 for detailed instructions.

Control Systems are always supplied with the settings shown on the relevant data sheet.

### 11.5 OPERATIONAL TEST

This test should be carried out on a level floor with at least one meter clear space around the wheelchair.

- Switch on the control system.
- Check that the battery gauge remains on, or flashes slowly, after one second.
- Push the joystick slowly forwards until you hear the parking brakes operate. The chair may start to move.
- Immediately release the joystick. You must be able to hear each parking brake operate within a few seconds.



- Repeat the test a further three times, pushing the joystick slowly backwards, left and right.

## 11.6 TEST DRIVE

- Drive the wheelchair and make sure that it operates correctly for all positions of the user controls.

## 11.7 SOFT-STOP TEST

- Drive the wheelchair at full forward speed and switch the control system off.
- The wheelchair must not stop suddenly, but should decelerate to standstill.

In addition, ensure that the requirements in section 1.3 of this chapter are satisfied.

## 11.8 LIGHTS, INDICATORS AND HAZARD LAMPS TEST

If lights are fitted:

- Visually check each bulb for correct illumination.
- Check each bulb for correct illumination and that the flashrate is  $1.5\text{Hz} \pm 0.5\text{Hz}$ .
- Disconnect each bulb in turn and check that the remaining bulb for that side flashes at  $3\text{Hz} \pm 0.5\text{Hz}$ .

If hazard lamps are fitted:

- Check each bulb for correct illumination and that the flashrate is  $1.5\text{Hz} \pm 0.5\text{Hz}$ .

## 11.9 ACTUATOR TEST

If actuators are fitted:

- Check each motor for correct direction of movement.
- Ensure the mechanical end-stops are secure and that they stall the actuator motors, thus operating the ISM's automatic end-stop detection.

## 11.10 INHIBIT INPUT TEST

Insert an appropriate battery charger, or equivalent inhibit connection, into the Charger Connector on the JSM and ensure that drive is inhibited.

If Inhibits 2, 3, 4 and 5 are used for inhibit or speed limiting purposes, suitable tests should be devised to ensure correct operation.

# 12 ELECTROMAGNETIC COMPATIBILITY (E.M.C.)

The R-net family has been tested for compliance with EC directive 89/336/EEC, and the E.M.C. requirements of EN12184, the FDA and the FCC. The guidelines in this section will help you to make sure that your wheelchair installation will easily meet these requirements. You should consider E.M.C. and perform relevant tests as early as possible in the design phase.



## 12.1 EMISSIONS

A typical wheelchair and R-net installation have been type tested and have passed the requirements of CISPR 22 and FCC CFR47 part 15.

Observe the following recommendations to minimize radio frequency emissions:

### 12.1.1 MOTOR SUPPRESSION

For the drive motors solder a suitable suppression capacitor between the brush holders, inside the motor cases. Keep the capacitor's lead length as short as possible. We recommend a value of 4n7F 250V AC ceramic. The maximum value you should use is 10nF. A typical type is Roderstein WY0472MCMCF0K.

The above should also be applied to actuator motors, if fitted. If it is not possible to fit these capacitors inside the actuator motors, then contact the motor manufacturers for further advice. Alternatively, placing the capacitor externally, but as close as possible to the motor, may have the same effect.

Some actuators have their own EMC suppression components fitted internally. In these instances, it may not be appropriate to introduce further capacitance. If you are uncertain, contact the actuator manufacturers for further advice.

### 12.1.2 CABLES

You do not need to use screened battery and motor looms, but:

- Keep the length of all wiring to a minimum.
- Make sure the loop area of the wiring is minimized. Route the positive and negative wires to each motor together. Route the battery positive and negative wires together. Where possible, route the battery and motor looms together. If fitted, route the lighting, indicator and actuator wires together.
- Secure all looms to the wheelchair's chassis over as much of their length as is practical.
- Do not use the control system connectors as junction points for the battery connections. Separate junction points away from the Power Module should be provided for the other wheelchair electrical functions.

## 12.2 IMMUNITY

The R-net control system family has been stringently tested for susceptibility to electromagnetic radiation over the frequency range 26MHz to 1GHz. The installations passed the FDA requirements and the proposed requirements of EN12184.

Follow the recommendations in section 12.1.2 to ensure maximum immunity to electromagnetic radiation.

## 12.3 ELECTRO-STATIC DISCHARGE (E.S.D.)

There are various international standards currently under development for this aspect of the system's performance. At present, most of the standards are specifying the system to be tested to requirements of IEC1000-4-2. Tests are carried out at 8kV air discharge (to nonconductive surfaces) and 6kV contact discharge (to conductive surfaces). The R-net family has been tested to these levels.

If you need advice please contact Curtiss-Wright.





## 13 BATTERY GAUGE

Refer to Chapter 1 for how to read the battery gauge.

The battery gauge typically starts to flash slowly when the battery voltage falls below 23.3V whilst the wheelchair is driving on a level surface.

For optimum accuracy of the battery gauge and low battery indicator, the control system should be programmed with the approximate nominal capacity of the wheelchair battery. However, accuracy is not greatly affected if the programmed type and capacity do not closely match the battery.

The most important factor affecting the accuracy of the battery gauge is the resistance of the cable and connections between the battery and the control system. The control system must be matched approximately to the cable resistance of your wheelchair to make the battery gauge accurate. The parameter for adjustment is Cable Resistance, refer to Chapter 3.

As a guide, 2.5mm<sup>2</sup> cable has a resistance of about 8 milliohms per meter; 4.0mm<sup>2</sup> cable has about 5 milliohms per meter and 6.0mm<sup>2</sup> has about 3.3 milliohms per meter. Circuit breakers and connectors usually account for about 15 milliohms.

These values will be chosen at the time the control system is being specified by the wheelchair manufacturer. Like the preset acceleration rates, once the values for the battery are decided, they are programmed into control systems during manufacture and should never need changing. If you need advice, contact Curtiss-Wright.





## CHAPTER 3 – PROGRAMMING

### 1 INTRODUCTION

This chapter gives an overview of the programmable parameters within the R-Net control system. The R-Net can be programmed using either the On-board Programming (OBP) facility, the Diagnostic Test Tool (DTT) or a Curtiss-Wright R-Net PC Programmer.

**WARNING:**

**Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Curtiss-Wright accepts no responsibility for losses of any kind if the programming of the control system is altered from the factory pre-set values.**

### 2 ON-BOARD PROGRAMMING

On-Board Programming (OBP) allows the wheelchair to be programmed, via the Joystick Module, to suit an individual user. There is no need for any additional programming hardware. While in OBP mode, the joystick and the speed control buttons are used to navigate the menus and make parameter adjustments.

If a parameter is available in OBP mode the title used on the LCD will be listed, in brackets, next to the Parameter Title in this chapter.

Example: 6.9 Maximum Forward Deceleration - (Fwd Decel Max)

#### 2.1 HOW TO ENTER OBP MODE

OBP in the field can be entered via two methods – connection of a hardware dongle or a keycode. The actual method required is set by the factory programming of the control system.

**NOTE:**

**OBP is not possible using an LED Joystick Module.**

If the hardware dongle method is set, then a Curtiss-Wright OBP Dongle needs to be connected to allow access to OBP. To use the dongle, follow the sequence below:

- Turn off the control system.
- Insert the R-net Dongle along the communication cables in the system configuration.
- Turn on the control system.
- After initialization press the Mode key until the OBP screen is reached. See following diagram.



OBP MENU	
Speeds	>
Drive	>
Controls	>
Latched	>
ISM Actuators	>

If the keycode method is set, then the following button sequence will allow entry to OBP. Note, a dongle will also allow OBP access if this method is set.

- Hold down the Horn button and then hold down the On/Off button until there is a short bleep. Note, the normal power-up sound will occur prior to this bleep.
- Release the Horn button, but continue to hold down the On/Off button until there are two further short beeps.
- Release the On/Off button, there will now be a longer bleep and OBP mode will be entered. See previous diagram.

**WARNING:**

If the keycode method is set, then it may be possible for a wheelchair user to gain entry to the OBP function. Curtiss-Wright accepts no liability for losses of any kind if this method of OBP is set. Curtiss-Wright also accepts no liability for losses of any kind if OBP access is gained by unauthorised personnel obtaining a dongle.

## 2.2 NAVIGATING THE OBP SCREENS

Whilst in OBP deflecting the joystick to the left, whilst the parameter title is highlighted, will display an elongated version of the parameter name.

There are two basic forms of display screen – one which shows global parameters and one which shows parameters which are profile dependent, i.e. can have different values in each of the drive profiles.

Example of a global parameter screen:

Global Controls	
Steer Correct	0
Sounder Volume	5
Endstop Bleep	no
Act. Entry Axis	1
Chge Prf in Drv	yes

Forward joystick deflections will select the parameter above.  
Reverse joystick deflections will select the parameter below.  
Left joystick deflections will take you to the previous screen.  
Right joystick deflections will have no effect.

Example of a profiled parameter screen:

FWD	Pr1	Pr2	Pr3	Pr4
Acc▲	30	35	40	45
Acc▼	20	20	20	20
Dec▲	40	40	45	50
Dec▼	30	30	30	30
Spd▲	70	80	90	100
Spd▼	20	25	30	20

Forward joystick deflections will select the parameter above.  
Reverse joystick deflections will select the parameter below.  
The first left joystick deflection will display the parameter name in full.  
The second left joystick deflection will take you to the previous screen.  
Right joystick deflections will select the parameter to the right, if available.



## 2.3 MAKING AN ADJUSTMENT

Once the parameter for adjustment has been selected, the Speed buttons can be used to make adjustments.

### NOTE:

To ensure all new values are stored correctly, exit OBP mode with a series of left hand joystick deflections.

## 3 PC PROGRAMMER - OEM PARAMETER LIST (\* DENOTES PRESENT IN OBP)

### Profile Management

Profile Name	<i>Sets the Profile Name</i>
*Profile Enable	<i>Sets if a Profile is available</i>
*Mode Enable	<i>Sets which Modes are available in specific Profiles</i>
*Input Device Type	<i>Sets which Input Device is active within a Profile</i>
Input Device Subtype	<i>Sets which Input Device Subtype is active within a Profile</i>
Seat Reversal Profile	<i>Sets which Profiles relate to each configuration</i>
Allow Grab	<i>Sets which Input Device can grab focus.</i>

### Configuration

Mode Name	<i>Sets the Mode Name</i>
Input	<i>Sets the data the Input Device transmits to the Output Device</i>
Output	<i>Sets which Output Device is active for a specific Mode</i>

### Speeds

*Maximum Forward Speed	<i>Sets maximum forward speed</i>
*Minimum Forward Speed	<i>Sets minimum forward speed</i>
*Maximum Reverse Speed	<i>Sets maximum reverse speed</i>
*Minimum Reverse Speed	<i>Sets minimum reverse speed</i>
*Maximum Turn Speed	<i>Sets maximum turning speed</i>
*Minimum Turn Speed	<i>Sets minimum turning speed</i>
*Maximum Forward Acceleration	<i>Sets maximum forward acceleration</i>
*Minimum Forward Acceleration	<i>Sets minimum forward acceleration</i>
*Maximum Forward Deceleration	<i>Sets maximum forward deceleration</i>
*Minimum Forward Deceleration	<i>Sets minimum forward deceleration</i>
*Maximum Reverse Acceleration	<i>Sets maximum reverse acceleration</i>
*Minimum Reverse Acceleration	<i>Sets minimum reverse acceleration</i>
*Maximum Reverse Deceleration	<i>Sets maximum reverse deceleration</i>
*Minimum Reverse Deceleration	<i>Sets minimum reverse deceleration</i>
*Maximum Turn Acceleration	<i>Sets maximum turning acceleration</i>
*Minimum Turn Acceleration	<i>Sets minimum turning acceleration</i>
*Maximum Turn Deceleration	<i>Sets maximum turning deceleration</i>
*Minimum Turn Deceleration	<i>Sets minimum turning deceleration</i>
*Power	<i>Reduces power to minimize risk of indoor fittings damage</i>
*Torque	<i>Torque boost to overcome obstacles at low speed settings</i>
*Tremor Damping	<i>Adjustable damping to reduce the effect of hand tremor</i>
Fast Brake Rate	<i>Sets the Fast Brake Rate</i>

### Controls

Global Controls	
*Momentary Screens Enabled	<i>Sets whether the momentary screens are enabled</i>
*Change Profile while Driving	<i>Sets if it is possible to change between profiles whilst driving</i>
*Change Speed while Driving	<i>Sets if the speed buttons are active whilst driving</i>
*Speed Adjust	<i>Sets if the Joystick speed buttons are active</i>
Profile Button	<i>Sets the functionality of the profile button</i>



*Actuator Endstop Bleep	<i>Sets whether there is a bleep when a seat axis reaches endstop</i>
*Sounder Volume	<i>Sets volume of audible feedback from JSM</i>
*Lock Function Enabled	<i>Sets how the lock function is activated</i>
*Reverse Driving Alarm	<i>Sets if the reverse driving alarm is active</i>
*Emergency Stop Switch	<i>Allows latched operation without the use of an Emergency Stop switch</i>
OBP Keycode Entry	<i>Sets the method of entry of OBP</i>
*Power-up Mode	<i>Sets the Mode that will be active when the system is powered-up</i>
External Profile Jack Function	<i>Sets which type of external input is to be connected to the system</i>
Actuator Switches while Driving	<i>Sets whether seating adjustment is permitted while the wheelchair is driving</i>
Start Up Bleep	<i>Sets whether a short beep occurs when the control system is powered-up</i>
Profile/Mode Jack Detect	<i>Sets whether the CJSM2 performs error checking on the connected switch</i>
On/Off Jack Detect	<i>Sets whether the CJSM2 performs error checking on the connected switch</i>
<b>Joystick</b>	
*Joystick Forward Throw	<i>Sets the amount of joystick movement required to reach full speed in this direction</i>
*Joystick Reverse Throw	<i>Sets the amount of joystick movement required to reach full speed in this direction</i>
*Joystick Left Throw	<i>Sets the amount of joystick movement required to reach full speed in this direction</i>
*Joystick Right Throw	<i>Sets the amount of joystick movement required to reach full speed in this direction</i>
*Joystick Deadband	<i>Sets the joystick deadband (size of neutral position)</i>
*Invert Left Right JS Axis	<i>Sets if the joystick Left/Right axis is inverted</i>
*Invert Fwd Rev JS Axis	<i>Sets if the joystick Fwd/Rev axis is inverted</i>
*Swap Joystick Axis	<i>Swaps the joystick's Fwd/Rev and Left/Right axes</i>
<b>Profiled</b>	
*Change Mode while Driving	<i>Sets if it is possible to change between Modes whilst driving</i>
*Sleep Timer	<i>Sets the period of inactivity before the Control System powers down</i>
*Standby Time	<i>Sets the period of inactivity before Standby Mode is entered.</i>
*Switch to Standby	<i>Sets if an external input switch can be used to enter Standby Mode</i>
*Mode Selection in Standby	<i>Sets if the joystick can be used to select Modes when in Standby Mode</i>
Standby in Modes	<i>Sets the Modes that Standby will operate in</i>
Standby Forward	<i>Sets which Mode is entered with a forward command</i>
Standby Reverse	<i>Sets which Mode is entered with a reverse command</i>
Standby Left	<i>Sets which Mode is entered with a left command</i>
Standby Right	<i>Sets which Mode is entered with a right command</i>
*Remote Selection	<i>Sets whether Profiles and Mode can be selected and entered with joystick deflections</i>
*Background	<i>Sets the default background for each profile</i>
<b>Speed Paddles</b>	
Speed Paddle Operation	<i>Sets whether speed adjustment is via a momentary or continuous operation of the CJSM2's Speed Paddle</i>
Speed Step Size	<i>Sets by how much the speed setting will change when the CJSM2's Speed Paddle is operated</i>
Speed Step Rate	<i>Sets the rate at which speed setting changes occur when the Speed Paddle is deflected</i>
Speed Wrap Time	<i>Sets a time delay between the speed setting wrapping from maximum to minimum.</i>
Speed Wrap Delay	<i>Sets a time delay after a wrap before the speed setting increases from the minimum level</i>
Speed Wrap Bleep	<i>Sets whether there is an audible beep when the CJSM2's speed setting wraps from maximum to minimum</i>
<b>Latched</b>	
*Latched Drive	<i>Selects latched drive operation</i>
*Latched Actuators	<i>Selects latched actuator operation</i>
*Latched Timeout	<i>Sets the timeout period for latched operation</i>
*Latched Timeout Bleep	<i>Sets whether a bleep occurs as the timeout period approaches</i>
<b>Seating</b>	
Seating module Enabled	<i>Sets which Module is active – SM or ISM</i>
<b>ISM8/CxSM</b>	
<b>Global</b>	
Actuator Endstop Bleep	<i>For parameter information - Refer to the Chapter – ISM8</i>
Actuator Mode Entry Axis	<i>For parameter information - Refer to the Chapter – ISM8</i>
<b>Axis Setup</b>	
Axis Channels	<i>For parameter information - Refer to the Chapter – ISM8</i>



Axis Display	<i>For parameter information - Refer to the Chapter – ISM8</i>
Invert Channel Direction	<i>For parameter information - Refer to the Chapter – ISM8</i>
Channels	
*Acceleration	<i>For parameter information - Refer to the Chapter – ISM8</i>
*Deceleration	<i>For parameter information - Refer to the Chapter – ISM8</i>
*Up Speed	<i>For parameter information - Refer to the Chapter – ISM8</i>
*Down Speed	<i>For parameter information - Refer to the Chapter – ISM8</i>
Up Current Limit	<i>For parameter information - Refer to the Chapter – ISM8</i>
Down Current Limit	<i>For parameter information - Refer to the Chapter – ISM8</i>
Endstop Autodetect	<i>For parameter information - Refer to the Chapter – ISM8</i>
Actuator Endstop Timeout	<i>For parameter information - Refer to the Chapter – ISM8</i>
Intelligent Seating Module	
Global	
*Actuator Mode Entry Axis	<i>Sets the default axis when Seating Mode is entered</i>
Axis Setup	
Axis Channels	<i>Sets which actuator motor channels on the ISM will operate for a particular axis</i>
Axis Display	<i>Sets the user display for a particular axis</i>
Invert Axis Direction	<i>Sets whether a channel direction is inverted for a particular axis</i>
Axis Name	<i>Sets the text that will be displayed when an actuator is selected</i>
Channels	
*Acceleration	<i>Sets the acceleration for each actuator channel</i>
*Deceleration	<i>Sets the deceleration for each actuator channel</i>
*Up Speed	<i>Sets the speed in the up direction for each actuator channel</i>
*Down Speed	<i>Sets the speed in the down direction for each actuator channel</i>
Up Current Limit	<i>Sets the maximum current output in the up direction for each actuator channel</i>
Down Current Limit	<i>Sets the maximum current output in the down direction for each actuator channel</i>
Endstop Autodetect	<i>Sets if the automatic endstop function for a particular actuator channel operates</i>
Actuator Endstop Timeout	<i>Sets the period of time before the drive is cut at an endstop position</i>
Seating Module	
Global	
Actuator Mode Entry Axis	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Axis Setup	
Axis Enabled	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Up Speed	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Down Speed	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Axis End force	
Actuator Endstop Timeout	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Axis Display	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Axes Inhibits	
Up Assign	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Up: Inhibit in bands	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Down Assign	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Down: Assign in bands	<i>For parameter information - Refer to the Chapter – ELPM 90, JSM-LED &amp; SM</i>
Battery	
Low Battery Alarm	<i>Sets whether there will be an audible alarm to signal a low battery condition</i>
Low Battery Flash Level	<i>Sets the point at which the battery gauge on the LCD screen starts to flash</i>
Cable Resistance	<i>Calibrates the system to compensate for the electrical resistance of the battery cables</i>
Calibration Factor	<i>Allows further fine calibration of the battery gauge</i>
Low Voltage Cut-out	<i>Sets the voltage level at which the low voltage timer will start</i>
Low Voltage Time	<i>Sets the period of time that the voltage must be below the above parameter before drive is cut</i>
General	
Brake Disconnected Alarm	<i>Sets whether there is an audible alarm when a brake(s) is disconnected</i>
Brake Fault Detect	<i>Sets whether the Power Module will detect electrical faults in the wheelchair's brakes</i>
Brake Voltage	<i>Sets the voltage output from the Power Module to the wheelchair's electrical brakes</i>
Soft Stop Rate	<i>Sets the deceleration rate that is used while the wheelchair is "soft-stopping"</i>



Seat Reversal	<i>Sets the various options for wheelchairs that have a reversing seat</i>
Charger Inhibit 3 Enable	<i>Dedicates the Inhibit 3 input on the Power Module to operate with an On-Board Charger</i>
Charger Inhibit 3 Latching	<i>Sets whether the OBC inhibit (PM Inhibit 3) as described above is latching or non-latching</i>
Charger Inhibit 1 Latching	<i>Sets whether Inhibit 1 (JSM Charger Socket) is latching or non-latching</i>
Charger Inhibit 1 Alarm	<i>Sets whether an alarm sounds if there is an inhibit present on the JSM Charger Socket</i>
Charger Inhibit 3 Alarm	<i>Sets whether an alarm sounds if there is an inhibit present on the PM Inhibit 3</i>
Front Wheel Drive	
Front Wheel Drive Type	<i>Sets specific specialist software to support Front Wheel Drive Wheelchairs</i>
Front Wheel Drive	<i>Selects specialist software for front wheel driven wheelchairs</i>
FWD Acceleration	<i>Sets the limit of forward acceleration when exiting a turn</i>
Advanced Electronic Stability (AES)	
Advanced Electronic Stability	<i>Sets whether the specialist stability software is turned on</i>
AES Rate	<i>Sets the rate of adjustment of Advanced Electronic Stability</i>
<b>Motor</b>	
Global	
Maximum Current Limit	<i>Sets the long term maximum current output of the Power Module</i>
Boost Drive Current	<i>Sets the short term maximum current output of the Power Module</i>
Boost Drive Time	<i>Sets the period of time that the level of current set by Boost Drive Current is available</i>
Current Foldback Threshold	<i>Sets the level of current which, if exceeded, will start the current foldback timer</i>
Current Foldback Time	<i>Sets the period of time that the current must exceed the above parameter before the current is reduced</i>
Current Foldback Level	<i>Sets the level of current output reduction</i>
Compensation	<i>Matches the PM to the motors</i>
Invert M1 Direction	<i>Inverts the direction of rotation of motor channel M1 on the Power Module</i>
Invert M2 Direction	<i>Inverts the direction of rotation of motor channel M2 on the Power Module</i>
Motor Swap	<i>Swaps the motor output channels, M1 and M2, of the Power Module</i>
*Steer Correct	<i>Adjusts the PM outputs to compensate for mis-matched motors</i>
*Display Speed	<i>Sets whether the speed and odometer is displayed in miles per hour or kilometers per hour</i>
Displays	<i>Sets the format of the digital speed display to be Speed, Odometer or Both</i>
Maximum Rated Speed	<i>This calibrates the speedometer function</i>
*Maximum Displayed Speed	<i>This sets the operation of the graphical speed display</i>
Joystick Stationary Time	<i>Sets the period of time that the joystick must be deflected before drive is removed</i>
Joystick Stationary Range	<i>Sets the 'window' within which the joystick is considered to be stationary</i>
Profiled	
Compensation Factor	<i>Allows different values of Compensation to be used across different profiles.</i>
<b>Inhibits</b>	
Global	
Disable Inhibit 2 in Drive	<i>Sets whether the PM Inhibit 2 input is interrogated constantly or just at entry into Drive Mode</i>
Disable Inhibit 3 in Drive	<i>Sets whether the PM Inhibit 3 input is interrogated constantly or just at entry into Drive Mode</i>
Disable Inhibit 8 in Drive	<i>For parameter information - Refer to the Specialist Chapter – ASM/TM</i>
Disable Inhibit 9 in Drive	<i>For parameter information - Refer to the Specialist Chapter – ASM/TM</i>
Inputs - PM	
Lower Level Threshold	<i>Sets the threshold between Band 0 and Band 1 for a particular Inhibit Input on the PM</i>
Middle Level Threshold	<i>Sets the threshold between Band 1 and Band 2 for a particular Inhibit Input on the PM</i>
Upper Level Threshold	<i>Sets the threshold between Band 2 and Band 3 for a particular Inhibit Input on the PM</i>
Debounce Time	<i>Sets a debounce time for the inhibit input.</i>
Inputs - ISM	
Lower Level Threshold	<i>Sets the threshold between Band 0 and Band 1 for a particular Inhibit Input on the ISM</i>
Middle Level Threshold	<i>Sets the threshold between Band 1 and Band 2 for a particular Inhibit Input on the ISM</i>
Upper Level Threshold	<i>Sets the threshold between Band 2 and Band 3 for a particular Inhibit Input on the ISM</i>
Debounce Time	<i>Sets a debounce time for the inhibit input</i>
Inputs – ISM8/CxSM	
Lower Level Threshold	<i>For parameter information - Refer to the Chapter – ISM8</i>
Middle Level Threshold	<i>For parameter information - Refer to the Chapter – ISM8</i>
Upper Level Threshold	<i>For parameter information - Refer to the Chapter – ISM8</i>
Debounce Time	<i>For parameter information - Refer to the Chapter – ISM8</i>





Inhibit Type	<i>For parameter information - Refer to the Chapter – ISM8</i>
Inputs – ASM/TM	
Lower Level Threshold	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Middle Level Threshold	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Upper Level Threshold	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Debounce Time Inh	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Drive Inhibits	
Assign	<i>Links the software inhibits to an actual hardware inhibit</i>
Speed Limit in Band 0	<i>Sets the max speed when the Inhibit Input, which is assigned to the Drive Inhibit, is in Band 0</i>
Speed Limit in Band 1	<i>Sets the max speed when the Inhibit Input, which is assigned to the Drive Inhibit, is in Band 1</i>
Speed Limit in Band 2	<i>Sets the max speed when the Inhibit Input, which is assigned to the Drive Inhibit, is in Band 2</i>
Speed Limit in Band 3	<i>Sets the max speed when the Inhibit Input, which is assigned to the Drive Inhibit, is in Band 3</i>
Operation	<i>Sets whether a full drive inhibit is a latching or non-latching function</i>
Inhibit Alarm	<i>Sets whether an audible alarm will sound in a full drive inhibit condition</i>
Actuator Channel 'x' Inhibits	
Up: Assign	<i>Links the software inhibits to an actual hardware inhibit</i>
Up: Inhibit in Bands	<i>Sets the condition of the input that will result in an inhibit of an actuator channel in the up direction</i>
Up: Alarm	<i>Sets whether an audible alarm will sound when an actuator channel is inhibited in the up direction</i>
Down: Assign	<i>Links the software inhibits to an actual hardware inhibit</i>
Down: Inhibit in Bands	<i>Sets the condition of the input that will result in an inhibit of an actuator channel in the down direction</i>
Down: Alarm	<i>Sets whether an audible alarm will sound when an actuator channel is inhibited in the down direction</i>
Actuator Channel 'x' Inhibits ISM8/CxSM	
Up: Assign	<i>For parameter information - Refer to the Chapter – ISM8</i>
Up: Inhibit in Bands	<i>For parameter information - Refer to the Chapter – ISM8</i>
Up: Alarm	<i>For parameter information - Refer to the Chapter – ISM8</i>
Down: Assign	<i>For parameter information - Refer to the Chapter – ISM8</i>
Down: Inhibit in Bands	<i>For parameter information - Refer to the Chapter – ISM8</i>
Down: Alarm	<i>For parameter information - Refer to the Chapter – ISM8</i>
<b>Lights</b>	
Global	
Indicator Fault Detection	<i>Sets whether defective turn indicator lamps can be detected</i>
Swap Indicators Seat Reversal	<i>Sets whether the indicator channels are exchanged when the seat is reversed</i>
Intelligent Seating Module	
Lamp Voltage	<i>Sets the operating voltage for the wheelchair's lighting system</i>
Brake Lights or Horn	<i>Sets whether the spare outputs on the ISM are assigned as Brake Lights or Horn</i>
Indicator Fault Detection 15V	<i>Sets whether defective LED turn indicator lamps can be detected at 15V</i>
Indicator Fault Detection 20V	<i>Sets whether defective LED turn indicator lamps can be detected at 20V</i>
Indicator Fault Detection 25V	<i>Sets whether defective LED turn indicator lamps can be detected at 25V</i>
Indicator Fault Detection 30V	<i>Sets whether defective LED turn indicator lamps can be detected at 30V</i>
Indicator Fault Detection 35V	<i>Sets whether defective LED turn indicator lamps can be detected at 35V</i>
Lighting Module	
Lamp Voltage	<i>For parameter information - Refer to the Chapter – Lighting Module</i>
Light Power	<i>For parameter information - Refer to the Chapter – Lighting Module</i>
Indicator Power	<i>For parameter information - Refer to the Chapter – Lighting Module</i>
Indicator Fault Power	<i>For parameter information - Refer to the Chapter – Lighting Module</i>
<b>OEM Factory</b>	
Absolute Max Torque	<i>Sets the maximum programmable value</i>
Absolute Minimum Power	<i>Sets the minimum programmable value</i>
Absolute Maximum Forward Speed	<i>Sets the maximum programmable value</i>
Absolute Minimum Forward Speed	<i>Sets the minimum programmable value</i>
Absolute Maximum Reverse Speed	<i>Sets the maximum programmable value</i>
Absolute Minimum Reverse Speed	<i>Sets the minimum programmable value</i>
Absolute Maximum Turning Speed	<i>Sets the maximum programmable value</i>
Absolute Minimum Turning Speed	<i>Sets the minimum programmable value</i>
Absolute Maximum Forward Acceleration	<i>Sets the maximum programmable value</i>



Absolute Minimum Forward Acceleration	<i>Sets the minimum programmable value</i>
Absolute Maximum Forward Deceleration	<i>Sets the maximum programmable value</i>
Absolute Minimum Forward Deceleration	<i>Sets the minimum programmable value</i>
Absolute Maximum Turn Acceleration	<i>Sets the maximum programmable value</i>
Absolute Minimum Turn Acceleration	<i>Sets the minimum programmable value</i>
Absolute Maximum Turn Deceleration	<i>Sets the maximum programmable value</i>
Absolute Minimum Turn Deceleration	<i>Sets the minimum programmable value</i>
Absolute Maximum Reverse Acceleration	<i>Sets the maximum programmable value</i>
Absolute Minimum Reverse Acceleration	<i>Sets the minimum programmable value</i>
Absolute Maximum Reverse Deceleration	<i>Sets the maximum programmable value</i>
Absolute Minimum Reverse Deceleration	<i>Sets the minimum programmable value</i>
Latched Drive Enabled	<i>Disables latched drive</i>

**Encoders**

Encoder Module Fitted	<i>For parameter information - Refer to the Chapter – Encoder</i>
Encoder Error Speed Limit	<i>For parameter information - Refer to the Chapter – Encoder</i>
Invert M1	<i>For parameter information - Refer to the Chapter – Encoder</i>
Invert M2	<i>For parameter information - Refer to the Chapter – Encoder</i>
Encoder Resolution	<i>For parameter information - Refer to the Chapter – Encoder</i>
Motor Rated Speed	<i>For parameter information - Refer to the Chapter – Encoder</i>

**Stability**

## Advanced Stability Module

## Global

Function	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Orientation	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Null Calibration	<i>For parameter information - Refer to the Chapter – ASM/TM</i>

## Accelerometer

Accelerometer Module Fitted	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Accelerometer Error Speed Limit	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Maximum Acceleration Threshold	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Minimum Acceleration Threshold	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Minimum Forward Speed Scalar	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Anti-Spin	<i>For parameter information - Refer to the Chapter – ASM/TM</i>

## Tilt

Forward Tilt Input	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
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## Tilt Module

Orientation	<i>For parameter information - Refer to the Chapter – ASM/TM</i>
Forward Tilt Input	<i>For parameter information - Refer to the Chapter – ASM/TM.</i>

## Gyro

## Global

Gyro Module Fitted	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Orientation	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Gyro Error Speed Limit	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Angular Speed Scalar	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Proportional gain	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Integral Gain	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Dynamic Gain	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Low Speed Proportional Gain	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
Low Speed Integral Gain	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>

## Profiles

Gyro Profile Select	<i>For parameter information - Refer to the Chapter – Gyro Module.</i>
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## 4 PROFILE MANAGEMENT

### PROFILES AND MODES EXPLAINED

The operation of the R-net system is based around the concept of Profiles and Modes.

A Profile is a collection of programmable parameters that affect the operation and performance of the wheelchair. It is typical to have 5 Profiles, each set-up to give a different driving performance. For example, Profile 1 may have very slow settings for speeds and accelerations, while Profiles 2 through to 5 would have progressively faster settings. In this way, the user can change the performance of the wheelchair by selecting the appropriate Profile with the Profile Button on the JSM. Although Profiles are used mainly to change driving performance, they can also contain parameters for other functions, such as seating control.

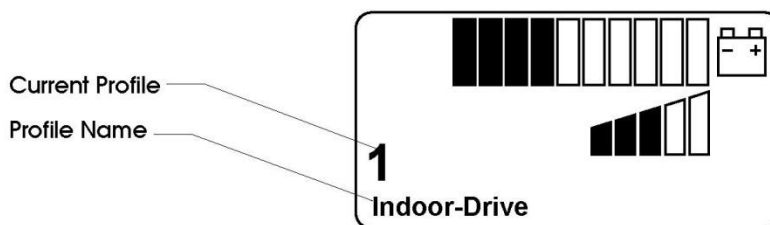
A Mode reflects the actual operation that occurs as a result of a joystick command. Typical examples are Drive Mode, Seating Control Mode and Bluetooth Mode. The user can select the required Mode with the Mode Button on the JSM. Note, it will only be possible to select a Mode if there is a Module that will support that Mode connected into the system. For example, if there is no Mouse Module connected, then the user will not be able to select that Mode.

### PROFILE MANAGEMENT

The R-net system can have up to 8 Profiles. Conventionally, Profile 8 is reserved for Dual Attendant Control (but can be re-assigned), meaning there are 7 possible user Profiles; but normally just 5 are used. The parameter, Profile Enable, sets whether a particular Profile is available to the user.

Operations of the Profile Button on the JSM simply select the next available Profile. When the highest available Profile is reached, the next Profile Button operation will simply select the lowest available Profile.

The LCD on the JSM displays the currently selected Profile as a text string of up to 20 characters. The number of the Profile is also displayed.



The Profile naming text is programmable, meaning you can choose your own description and language. The parameter, Profile Name, sets the text. Below is an example of programming for both Profile availability and naming.

Profile Management	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	Profile 7	Profile 8
Profile Name	Indoor	Slow	Medium	Fast	Sports	Profile 6	Profile 7	Attendant
Profile Enable	Yes	Yes	Yes	Yes	Yes	No	No	Yes

Profiles 1 to 5 are available to the user and have been given meaningful names. Profiles 6 and 7 are not available, and Profile 8 has been assigned to Dual Attendant operation.



## MODE MANAGEMENT

Within each available Profile, it is possible to select 7 different operating Modes. There are actually 8 Modes, however, Mode 8 is always reserved for On-Board Programming (OBP). A standard wheelchair is likely to have just 2 operating Modes – Drive (Mode 1) and Seating Control (Mode 2) – however, it is normal to set all Modes to be available, so that they will automatically be accessible when an additional Output Module is connected. If they are not programmed to be available, then if an additional Output Module, such as a Bluetooth Mouse Module is connected, the system would have to be programmed to recognize this new Module.

The parameter that sets whether a Mode is available is Mode Enable. Below is an example of programming to satisfy this requirement.

Profile Management	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	Profile 7	Profile 8
Profile Name	Indoor	Slow	Medium	Fast	Sports	Profile 6	Profile 7	Attendant
Profile Enable	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Mode Enable	[12345678]	[12345678]	[12345678]	[12345678]	[12345678]	[12345678]	[12345678]	[12345678]

However, this programming is not appropriate if it may be required to use just one button or switch to select Profiles and Modes. For this reason, it is recommended that programming as described in the following section is used.

## SELECTING PROFILE AND MODES WITH JUST ONE BUTTON

It may sometimes be required to use just one button or switch to select Profiles and Modes. A typical example would be the use of a Buddy Button connected into the External Profile Switch jack socket. The R-net system has been designed to allow this by applying the following rule.

Each operation of the External Profile Switch will select the next available Profile. Upon reaching the highest available Profile, the next operation of the switch will select the next available Mode, regardless of whether the Mode is available in the current Profile. Curtiss-Wright therefore recommend a programming set-up as below.

Profile Management	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	Profile 7	Profile 8
Profile Name	Indoor	Slow	Medium	Fast	Sports	Profile 6	Profile 7	Attendant
Profile Enable	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Mode Enable	[12345678]	[1     ]	[1     ]	[1     ]	[1     ]	[1     ]	[1     ]	[12345678]

In this set-up the External Profile Switch would step through Drive Profiles 1 to 5, then to Mode 2 (Seating Control) and then to other Modes if appropriate Output Modules are connected.

Note, if the programming set-up in the previous section was used, then the External Profile Switch would step through Drive Profiles 1 to 5, then it would step through 5 Seating Control Modes, each effectively the same. If more Output Modules were connected, it would be necessary to step through 5 times for each, before getting back to Drive Profile 1. Likewise, 5 steps through OBP would be needed to exit that function.

Note, the programming in this section will also work in the correct fashion when separate Profile and Mode buttons are used.

The basic rules are:

The Profile Button will select the next available Profile in the current Mode.

The Mode Button will select the next available Mode in the last Profile in which that Mode was used.

The External Profile Jack will select the same Mode in the next available Profile. When the highest available Profile for the current Mode is reached, then the next Mode in the next available Profile will be selected.



#### 4.1 PROFILE NAME

This is a 20 character text string that will appear on the JSM LCD screen to indicate the Profile that is selected. More information is given in the above text.

#### 4.2 PROFILE ENABLE - (PRFEN)

This sets whether a particular Profile is available for selection by the wheelchair user. More information is given in the above text.

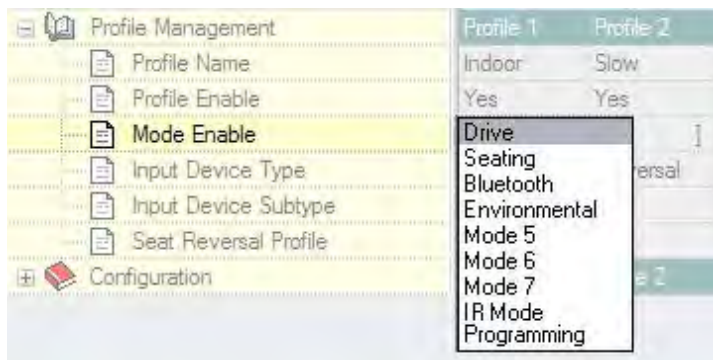
**NOTE:**

**A Control System utilizing an LED JSM should only be programmed with a maximum of 5 Profiles enabled.**

#### 4.3 MODE ENABLE (MODES)

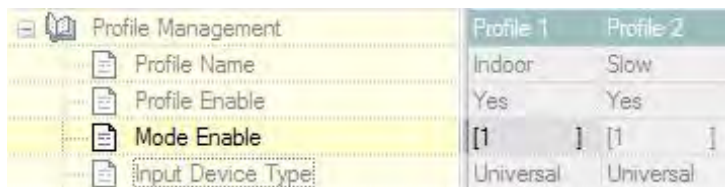
This sets which operating Modes are available in each of the Profiles. More information is given in the above text.

If this parameter is selected, a drop down menu as below will appear.



To set whether a Mode is enabled, simply highlight the appropriate menu item. Any combination of Modes can be selected.

When the drop down menu is closed the selected Modes are expressed as numbers and the parameter appears on the screen as below. The numbers 1 to 8 refer to the Modes listed in the menu.



#### INPUT DEVICES EXPLAINED

It is possible to connect two Input Devices of different types, for example, a conventional JSM and a Head Control into the same system. Alternatively, it is sometimes (but rarely) required, to connect two Input Devices of the same type.

The parameters Input Device Type, Input Device Subtype and Allow Grab, allow you to manage the priorities of control of the two connected Input Devices.



If two Input Devices are connected, the Profile buttons on those Input Devices can select only the Profiles relevant to themselves. For example, if Input Device 1 is set for Profiles 1, 2 and 3, and Input Device 2 is set for Profiles 4, 5 and 6; then the Profile button on Input Device 1 will be able to select just Profiles 1, 2 and 3, and the Profile Button on Input Device 2 will be able to select just Profiles 4, 5 and 6.

#### 4.4 INPUT DEVICE TYPE - (ID TYPE)

Each Profile can be set to work with any type of Input Device, or only with a specific type of Input Device. The parameter, Input Device Type, is used to set this function and there are currently twelve settings – Universal, JSM, Attendant, Omni, Switch-it, IOM 1, IOM 2, IOM 3, Compact JS, Compact JS Advanced, Easy Rider and Magic Drive.

If set to Universal, then any Input Device can control the Profile, and it will be the Input Device that was used to power-up the system that will be in control.

If set to anything other than Universal, then only the programmed type of Input Device can control the Profile.

#### 4.5 INPUT DEVICE SUBTYPE

In the rare event of it being required to have two identical Input Devices connected into the same system, for example, a left and right hand JSM, then the parameter, Input Device Subtype, can be used to manage this situation. There are three settings – All, 1 and 2. Note, this parameter is only relevant if the Input Devices are identical. In all other instances, it should be ignored.

If set to All, then either Input Device can control the Profile, and it will be the Input Device used to power-up the system that will be in control.

If set to 1, then only the older of the two Input Devices will be able to control the Profile.

If set to 2, then only the younger of the two Input Devices will be able to control the Profile.

The relative ages of the two Input Devices will be determined automatically by the R-net system. However, it will also be necessary for the Input Devices to be manually aged, in order to identify which is actually which. The relative ages are determined by the serial numbers, which have a format as below.

AXYYMM1234

YY and MM relate to year and month of manufacture. If there is no differentiation using this method, then the last four series digits will be used.

#### 4.6 SEAT REVERSAL PROFILE

This parameter is only relevant to wheelchair models that have a reversing seat, i.e. wheelchairs that can be operated in both rear wheel drive and front wheel drive configuration. The purpose of the parameter is to set which Profiles relate to each configuration, as it is normal to have different drive characteristics for the two set-ups.

There are two programmable options yes and no.

If set to yes, then the Profile will only be available when the seat is reversed. The seat is considered to be reversed when the Inhibit2 input on the Power Module is at 0V. For more details on seat reversal, please refer to section, Seat Reversal.

If set to no, then the Profile will only be available when the seat is not reversed.



## 4.7 ALLOW GRAB

This parameter can be used to prevent one type of Input Device conceding control to another.

AllowGrab determines if the Input Device can concede focus or not.

If this parameter is selected a dialog box as below will appear.



Example 1: To prevent a user gaining control from the Attendant.

The system is set up as below.

Input Device Subtype	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8
Seat Reversal Profile	No	No	No	No	No	No	No	No
Allow Grab	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Configuration	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8

Profiles 1 to 5 are set for any type of user Input Device

Profile 8 is set for Attendant control

AllowGrab is set to Yes for Profiles 1 to 5 meaning the Attendant can grab focus from any Input Device connected.

AllowGrab is set to No for Profile 8 meaning that other Input Devices cannot grab focus from the Attendant.

Example 2: In a playground environment a user must have the ability to take focus from the Attendant Module.

The system is set up as below.

Input Device Subtype	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8
Seat Reversal Profile	No	No	No	No	No	No	No	No
Allow Grab	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Configuration	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8

Profiles 1 to 5 are set for any type of user Input Device

Profile 8 is set for Attendant control

AllowGrab is set to Yes for Profiles 1 to 5 meaning the Attendant can grab focus from any Input Device connected.

AllowGrab is set to Yes for Profile 8 meaning that other Input Devices can grab focus from the Attendant.

### NOTE:

**It is not possible to set Allow Grab if the Input Device Type is Universal or IOM 1 - 3.**



It is not possible to set Allow Grab to No on more than one Input Device Type.

## CONFIGURATION EXPLAINED

The R-net system supports 8 Modes of operation. A Mode is the output action that the system is undertaking, for example, driving, seat adjustment or Mouse control. In other words, each Mode requires a piece of output hardware. For Drive it would be the Power Module, for Seat adjustment it would be the Seating Module and for Mouse control it would be a Bluetooth Mouse Module. Note, On-board Programming (OBP) will take over a Mode and by convention this will be Mode 8.

The system can be programmed to set which output function is active for each mode. In general, Mode 1 will always be Drive, Mode 2 will always be Seating Control and Mode 8 will always be OBP. However, it may be desirable to change the output assignment of some of the more specialist Modes. This can be achieved with the parameter, Output. See below for more details.

A Mode will only be available if the output hardware is actually connected in the system. The parameter, Output, is therefore essential in ensuring the full "Plug & Play" capabilities of R-net are utilized.

Example: A wheelchair model is launched with Drive and Seating functions, but it is intended to allow optional features such as environmental control or PC mouse control to be fitted in the field. To ensure this means no more than simply connecting appropriate pieces of hardware, then the system should be programmed as below.

Configuration	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	IR Mode	Mode 8
Mode Name	Drive	Seating	Bluetooth	Environmental	Mode 5	Mode 6	Mode 7	Programming
Input	Drive	Seating	Raw	Raw	Raw	Raw	Raw	Programming
Output	Drive	Seating	Mouse	Environmental	Output 5	Output 6	IR Output	Programming

This means that when the wheelchair is initially shipped, with a Power Module and Seating Module fitted, then Modes 1 and 2 will be Drive and Seating Control respectively and that Mode 8 would be used for OBP.

If, at some point in the future an Environmental Control Module is required, then Mode 4 would automatically become available to the user. I.e. the Mode button would step through Drive, Seating and Environmental Modes. The other Modes - PC Mouse, Output 5, Output 6 and Output 7 - would also become available if relevant modules were connected.

Within each Mode it is necessary to ensure the appropriate data is transmitted from the Input Device to the Output Device. A good example of this is the Speed Up and Speed Down button. In Drive Mode they change the speed setting in the Joystick Module and it is that setting, rather than the actual state of the buttons, that is transmitted to the Power Module. However, in Mouse Mode it is desirable for the state of the Speed Up and Speed Down buttons to be transmitted on the Output Device. This means the buttons can be used to control other functions, such as mouse left/right clicks. The parameter, Input, sets the data for each mode. See section, Input, for more details.

## : USER DISPLAYS :

There is some flexibility as to what is displayed to the user to indicate the operating Mode of the system. The Drive, Seating and OBP modes are indicated by the standard screens and cannot be changed. However, the Mouse Mode displays an image of a PC with an associated text string, whereas the other Modes simply have an associated text string. An example of a Mode screen is shown below. The text string is programmable via the parameter, Mode Name.



Bluetooth Mode





## 5.1 MODE NAME

This is a 20 character text string that will appear on the JSM LCD screen to indicate the active Mode. See *Configuration Explained* for more details.

### NOTE:

**Although there are options to change the Mode Names for Drive and Seating Modes, these text strings will not appear on the standard JSM screens. These text options are reserved for future Input Devices.**

## 5.2 INPUT

This sets the data that the Input Device transmits to the Output Device for each mode. See *Configuration Explained* for more details.

The programmable options are in the form of a drop-down menu, as shown in the following diagram.



Drive provides data that is appropriate for driving the wheelchair and should always be used for Drive mode, i.e. when the Power Module is the active Output Device.

Seating provides data that is appropriate for controlling the seating of the wheelchair and should always be used for Seating Control mode, i.e. when an ISM, or equivalent, is the active Output Device.

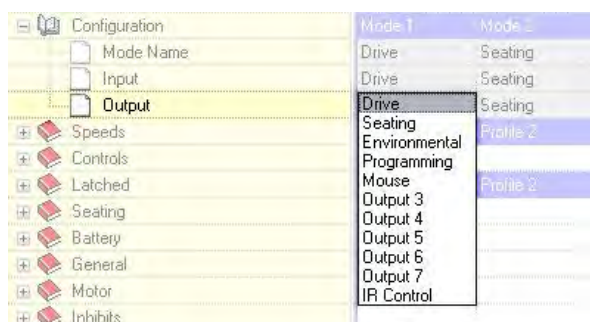
Raw provides basic joystick x and y data, but scaled for deadband, throw and orientation. Additionally, 'raw' button operations are also transmitted. This setting can be used for any other Output Module types.

Programming sets which Mode is reserved for OBP. This is usually Mode 8.

## 5.3 OUTPUT

This sets the Output Device that is active for the Mode. See *Configuration Explained* for more details.

The programmable options are in the form of a drop-down menu, as shown in the following diagram





Drive means that the Power Module is the active Output Device and Seating means that the Seating Module is the active Output Device.

Because OBP assumes a Mode, then if OBP is required one of the Modes, normally Mode 8, should be set to Programming.

There are some other Output Device identifiers that are currently defined, such as Environmental, these are for use with future planned Output Modules.

The settings Output 3 to Output 7 are unique identifiers that can be assigned to Input/Output Modules (IOMs).

**NOTE:**

**The number of unique identifiers is unlimited meaning any number of specialist modules can be supported.**

## 6 SPEEDS

### 6.1 MAXIMUM FORWARD SPEED - (FWD SPEED MAX)

Sets the forward driving speed of the wheelchair when the joystick is deflected full ahead and the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

### 6.2 MINIMUM FORWARD SPEED - (FWD SPEED MIN)

Sets the forward driving speed of the wheelchair when the joystick is deflected full ahead and the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Forward Speed in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Forward Speed higher than the value of Max. Forward Speed.**

### 6.3 MAXIMUM REVERSE SPEED - (REV SPEED MAX)

Sets the reverse driving speed of the wheelchair when the joystick is deflected to full reverse and the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

### 6.4 MINIMUM REVERSE SPEED - (REV SPEED MIN)

Sets the reverse driving speed of the wheelchair when the joystick is deflected to full reverse and the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Reverse Speed in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Reverse Speed higher than the value of Max. Reverse Speed.**



---

#### 6.5 MAXIMUM TURNING SPEED - (TURN SPEED MAX)

Sets the turning speed of the wheelchair when the joystick is deflected fully left or right and the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

---

#### 6.6 MINIMUM TURNING SPEED - (TURN SPEED MIN)

Sets the turning speed of the wheelchair when the joystick is deflected full left or right and the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Turning Speed in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Turning Speed higher than the value of Max. Turning Speed.**

---

#### 6.7 MAXIMUM FORWARD ACCELERATION - (FWD ACCEL MAX)

Sets the acceleration rate of the wheelchair in the forward direction when the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

---

#### 6.8 MINIMUM FORWARD ACCELERATION - (FWD ACCEL MIN)

Sets the acceleration rate of the wheelchair in the forward direction when the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Forward Acceleration in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Forward Acceleration higher than the value of Max. Forward Acceleration.**

---

#### 6.9 MAXIMUM FORWARD DECELERATION - (FWD DECEL MAX)

Sets the deceleration rate of the wheelchair in the forward direction when the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

---

#### 6.10 MINIMUM FORWARD DECELERATION - (FWD DECEL MIN)



Sets the deceleration rate of the wheelchair in the forward direction when the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Forward Deceleration in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Forward Deceleration higher than the value of Max. Forward Deceleration.**

---

#### 6.11 MAXIMUM REVERSE ACCELERATION - (REV ACCEL MAX)

Sets the acceleration rate of the wheelchair in the reverse direction when the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

---

#### 6.12 MINIMUM REVERSE ACCELERATION - (REV ACCEL MIN)

Sets the acceleration rate of the wheelchair in the reverse direction when the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Reverse Acceleration in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Reverse Acceleration higher than the value of Max. Reverse Acceleration.**

---

#### 6.13 MAXIMUM REVERSE DECELERATION - (REV DECEL MAX)

Sets the deceleration rate of the wheelchair in the reverse direction when the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

---

#### 6.14 MINIMUM REVERSE DECELERATION - (REV DECEL MIN)

Sets the deceleration rate of the wheelchair in the reverse direction when the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Reverse Deceleration in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Reverse Deceleration higher than the value of Max. Reverse Deceleration.**

---

#### 6.15 MAXIMUM TURN ACCELERATION - (TURN ACCEL MAX)

Sets the acceleration rate of the wheelchair into a turn when the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.



---

### 6.16 MINIMUM TURN ACCELERATION - (TURN ACCEL MIN)

Sets the acceleration rate of the wheelchair into a turn when the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Turn Acceleration in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Turn Acceleration higher than the value of Max. Turn Acceleration.**

---

### 6.17 MAXIMUM TURN DECELERATION - (TURN DECEL MAX)

Sets the deceleration rate of the wheelchair while turning when the speed setting is at maximum (all 5 bars illuminated).

Programmable range is 0 to 100% in steps of 1%.

---

### 6.18 MINIMUM TURN DECELERATION - (TURN DECEL MIN)

Sets the deceleration rate of the wheelchair while turning when the speed setting is at minimum (just 1 bar illuminated).

Programmable range is 0 to Maximum Turn Deceleration in steps of 1%.

**NOTE:**

**It is not possible to set the value of Minimum Turn Deceleration higher than the value of Max. Turn Deceleration.**

---

### 6.19 POWER - (POWER)

This reduces the power of the wheelchair. Power is the ability of a wheelchair to climb a hill or overcome an obstacle. If it is set to 100% then the wheelchair will provide full power. Values below 100% will result in reduced power.

A typical use is minimizing damage to doorways or furniture if the wheelchair is being used indoors. The values can be set independently between drive profiles, meaning separate indoor and outdoor profiles can be defined.

Programmable range is 25% to 100% in steps of 1%.

If the value is set to less than 100%, then the Boost Current function is automatically disabled. i.e. the reduction is applied to the Current Limit Max. value.

Example:            R-net is programmed to:    Maximum Current Limit = 80 Amps            Boost Drive Current = 120 Amps  
   Boost Drive Time = 5 Seconds            Power (Profile 1) = 100%  
   Power (Profile 2) = 50%

This means that in Profile 1 the system will be able to output 120A for 5 seconds before reducing to 80A, but in Profile 2 will output 50% of 80A = 40A with no boost.

---

### 6.20 TORQUE - (TORQ)

This parameter can be used to boost the power to the motors at low drive speeds. This is useful for overcoming obstacles such as door thresholds or thick pile carpets and for countering Rollback.

Programmable range is 0% to 100% in steps of 1%.



At 0% the parameter has no effect. The recommended value is 80%, however, if the wheelchair drive is considered to be jerky, then reduce this value.

## 6.21 TREMOR DAMPING - (TRMOR)

This parameter can be used to reduce the effects of a user's hand tremor.

The programmable range is 0% to 100%. The higher the value, the greater the damping that is applied

### **WARNING:**

**If using high values of Tremor Damping, pay particular attention to the stopping distance of the wheelchair, as it will be increased.**

## 6.22 FAST BRAKE RATE

This parameter sets the deceleration rate that is used while fast braking. Fast braking is when the joystick is pulled to the reverse position to make a faster stop.

The programmable range is 0 to 200.

If the value is set lower than the Forward Deceleration value, then the latter value will be used.

# 7 CONTROLS

## CONTROLS – GLOBAL

### 7.1 MOMENTARY SCREENS ENABLED - (MOMENTARY SCREENS)

This sets whether the large, momentary screens appear in between Profile and Speed setting changes.

The programmable options are Yes and No.

### 7.2 CHANGE PROFILE WHILE DRIVING - (CHGE PRF IN DRV)

This sets whether Profile changes are permitted while the wheelchair is driving.

The programmable options are Yes and No.

### 7.3 CHANGE SPEED WHILE DRIVING - (SPD ADJ IN DRV)

This sets whether the Speed Down and Speed Up buttons are active while the wheelchair is driving.

The programmable options are Yes and No.



---

## 7.4 SPEED ADJUST - (SPEED ADJUST)

This sets whether the Speed Down and Speed Up buttons on the Joystick Module are active.

The programmable options are Yes and No.

---

## 7.5 PROFILE BUTTON

This sets whether the Profile button on the JSM will select just Profiles, or Profiles and Modes.

The programmable options are Profiles and Profiles/Modes.

If set to Profiles, then the Profile button will select just the available Profiles.

If set to Profiles/Modes, then the Profile button on the JSM will select the available Profiles, then the available Modes. i.e. the operation is identical to a button connected into the External Profile Switch Jack.

---

## 7.6 ACTUATOR ENDSTOP BEEP - (ENDSTOP BEEP)

This sets whether a short beep occurs when an actuator mechanism reaches an end position.

The programmable options are Yes and No.

### NOTE:

**The beep will only occur on actuator mechanisms that use automatic endstop detection, i.e. over-current measurement.**

---

## 7.7 SOUNDER VOLUME - (SOUNDER VOLUME)

This sets the volume of the audible feedback given whenever a button or switch on the Joystick Module is operated.

The programmable range is 0 to 10 in steps of 1.

If set to 0, there will be no sound given. Higher values will give progressively louder sounds.

---

## 7.8 LOCK FUNCTION ENABLED – (LOCK FN ENABLE)

This sets if and how the R-net may be locked to prevent the wheelchair being used by unauthorised persons.

The programmable options are as follows:

None Means the R-net cannot be locked

Seq Means the keypad locking sequence can lock/unlock the R-net.

(Refer to Chapter 1 – Operation for sequence details).

Key Means a Curtiss-Wright supplied key can lock/unlock the R-net.

Both Means either the keypad or a key can be used to lock/unlock the R-net.

---

## 7.9 REVERSE DRIVING ALARM - (REV DRIVING ALARM)

This sets whether a warning alarm is sounded while the wheelchair is driving in reverse.

The programmable options are Yes and No.



---

## 7.10 EMERGENCY STOP SWITCH - (EMERGENCY STOP)

This sets whether an Emergency Stop Switch must be used when latched operation is programmed.

The programmable options are Yes and No.

If set to Yes, then a normally closed Emergency Stop Switch must be connected into the External Profile Switch Jack on the Joystick Module, whenever latched drive or latched actuator operation is programmed. If such a switch is not fitted, then operation of the wheelchair will be inhibited.

If set to No, then an Emergency Stop Switch is not required. This setting should only be used after a full assessment of the risks involved, i.e. there is no way of effecting an emergency stop from latched drive or actuator operation.

### **WARNING:**

**Curtiss-Wright accepts no liability for losses of any kind resulting from the use of a wheelchair with latched drive or actuator operation and with no normally closed Emergency Stop Switch fitted.**

---

## 7.11 OBP KEYCODE ENTRY

This sets the method of entry into On-Board Programming (OBP).

The programmable options are Yes and No.

If set to Yes, then a sequence of button presses can be used to enter OBP. The sequence is as detailed at the end of this section.

If set to No, then a hardware Dongle must be connected into the system in order to enter OBP.

OBP keycode entry is as follows:

- With the system switched off, hold down the Horn button and then hold down the On/Off button until there is a short beep. Note, the normal power-up sound will occur prior to this beep.
- Release the Horn button, but continue to hold down the On/Off button until there are two further short beeps.
- Release the On/Off button, there will now be a longer beep and OBP mode will be entered.

### **WARNING:**

**If this parameter is set to Yes, then it may be possible for a wheelchair user to gain entry to the OBP function. Curtiss-Wright accepts no liability for losses of any kind if this method of OBP is set. Curtiss-Wright also accept no liability for losses of any kind if OBP access is gained by unauthorised personnel obtaining a dongle.**

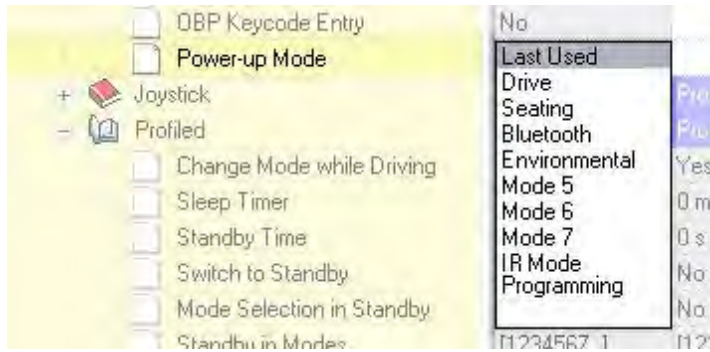
---

## 7.12 POWER-UP MODE – (POWER UP MODE)

This sets the Mode that is selected when the system is powered-up.

The programmable options are in the form of a drop down, as shown in the following diagram.





Simply select the required Mode. If Last Used is selected, then the Mode that was selected at the last power-down will be selected at the next power-up.

If a Mode is selected but the appropriate Output Module is not present, then the system will default to Drive Mode at power-up.

#### NOTE:

**This parameter is not applicable to IOMs**

## 7.13 EXTERNAL PROFILE JACK FUNCTION

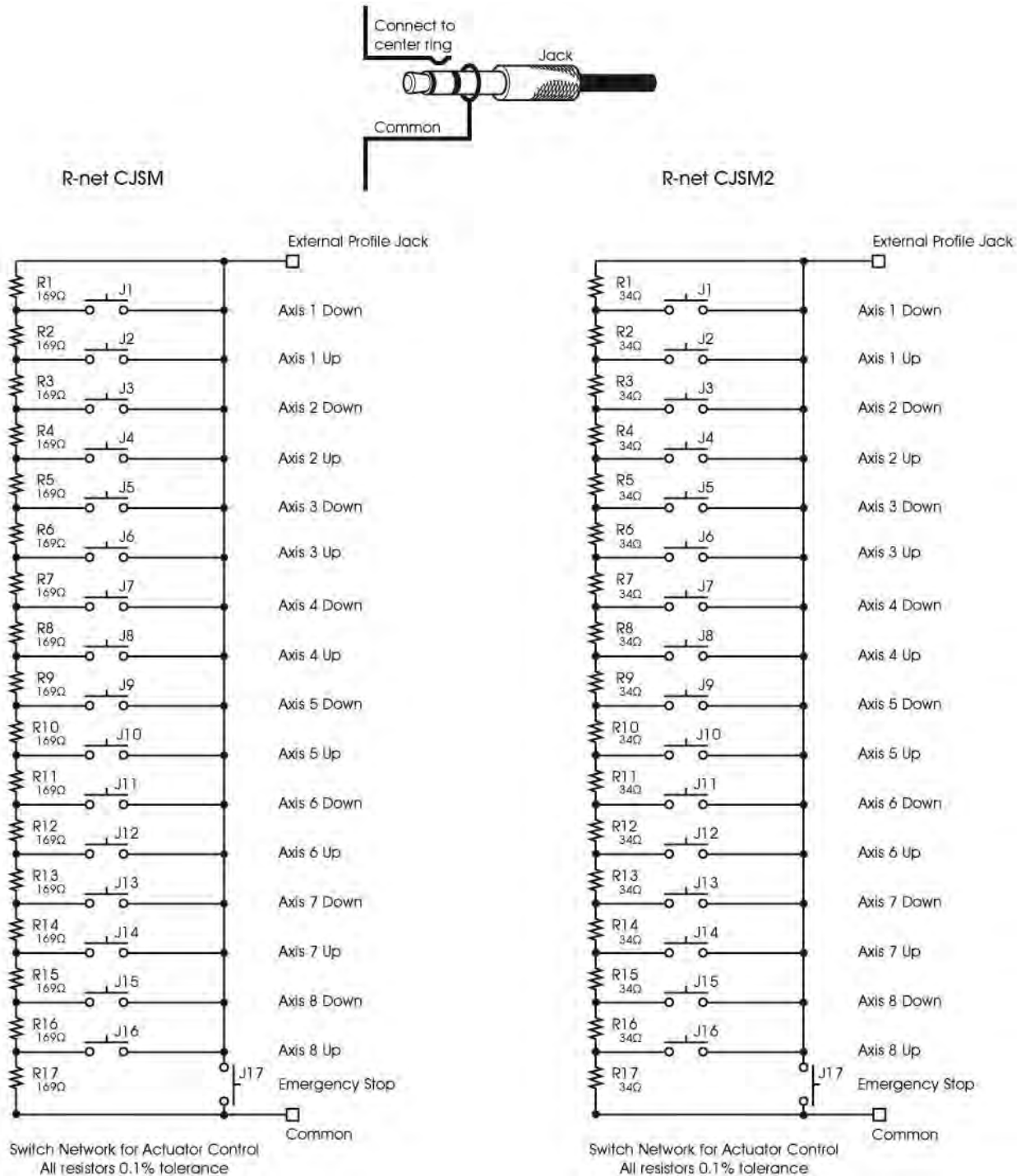
This sets whether single switch or a switch/resistor array (for multiple actuator control) can be connected to the External Profile Switch Jack.

The programmable options are Standard and Actuator Switches.

If set to Standard, a single switch can be connected.

If set to Actuator Switches, the External Profile Switch Jack will assume analogue operation. Dependent on the value of resistance connected to this input, then an actuator command will be issued. In total, 16 commands Axis 1 to 8, Up and Down, are supported, as well as an Emergency Stop function.

This functionality is only available on specific CJSMs. Details of the external input circuit is as follows.



#### NOTE:

It is the responsibility of the wheelchair OEM to undertake a risk assessment to determine if hazardous conditions can result from defects in the switch/resistor array or its wiring. Curtiss-Wright accept no liability for losses of any kind arising from the control of actuators from a switch/resistor array.



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## 7.14 ACTUATOR SWITCHES WHILE DRIVING

This sets whether seating adjustment, via a switch pad connected to the External Profile Switch Jack socket, is permitted while the wheelchair is driving.

This parameter is only active when parameter External Profile Jack Function is set to Actuator Switches.

The programmable options are Yes and No.

---

## 7.15 START UP BEEP

This sets whether a short beep occurs when the control system is powered-up.

The programmable options are Yes and No.

---

## 7.16 EXTERNAL PROFILE JACK DETECT

This sets the type of switch the CJS2 expects to be connected to the External Profile Switch Jack.

The programmable options are On and Off.

If set to On, the CJS2 will expect a switch with a 220Ohm resistor connected in series with its contacts and a 270Ohm resistor connected across its contacts to be connected to the External Profile Switch Jack, so will be able to detect both open- and short-circuits in the switch or its wiring. If such conditions are detected, the function associated with the External Profile Switch Jack will be disabled and a warning displayed on the screen.

### NOTE:

**To maximise the error-checking capability, the resistors must be fitted as physically close as possible to the switch contacts.**

If set to Off, the CJS2 will not check for errors in the external circuitry connected to the External Profile Switch Jack and a standard external switch can be used.

### WARNING:

**Curtiss-Wright recommend that if seat actuators are driven using this input and a single switch, then the switch must be fitted with a resistor as described above. Curtiss-Wright accept no liability for losses of any kind arising from the use of any other switch.**

---

## 7.17 EXTERNAL ON/OFF JACK DETECT

This sets the type of switch the CJS2 expects to be connected to the External On/Off Switch Jack, and the subsequent behaviour of the system.

The programmable options are On, Off and Limp.

If set to On, the CJS2 will expect a switch with a 220Ohm resistor connected in series with its contacts and a 270Ohm resistor connected across its contacts to be connected to the External On/Off Switch Jack, so will be able to detect both open- and short-circuits in the switch or its wiring. If such conditions are detected, a trip will occur.

### NOTE:



**To maximise the error-checking capability, the resistor must be fitted as physically close as possible to the switch contacts.**

If set to Off, the CJS2 will not check for errors in the external circuitry connected to the External On/Off Switch Jack and a standard external switch can be used.

If set to Limp, the CJS2 will expect a switch with a 220Ohm resistor connected in series with its contacts and a 270Ohm resistor connected across its contacts to be connected to the External On/Off Switch Jack, so will be able to detect both open- and short-circuit in the switch or its wiring. If such conditions are detected, the system will still allow drive but at a reduced speed and will issue visual and audible warning.

**NOTE:**

**To maximise the error-checking capability, the resistor must be fitted as physically close as possible to the switch contacts.**

**WARNING:**

**Curtiss-Wright recommend the switch must be fitted with a resistor as described above. Curtiss-Wright accept no liability for losses of any kind arising from the use of any other switch.**

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## CONTROLS – JOYSTICK

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### 7.18 JOYSTICK FORWARD THROW - (FORWARD THROW)

This sets the amount of forward movement of the joystick that is required to reach full forward speed. This is particularly useful for users with limited hand movement.

The programmable range is 25% to 100% in steps of 1%.

The percentage value corresponds to the amount of joystick deflection required to reach full forward speed. For example, if set to 50%, then only half joystick movement is needed to reach full speed.

The Forward Throw can also be set interactively with the user actually deflecting the joystick. See *Interactive Setting Explained*.

---

### 7.19 JOYSTICK REVERSE THROW - (REVERSE THROW)

This sets the amount of reverse movement of the joystick that is required to reach full reverse speed. This is particularly useful for users with limited hand movement.

The programmable range is 25% to 100% in steps of 1%.

The percentage value corresponds to the amount of joystick deflection required to reach full reverse speed. For example, if set to 50%, then only half joystick movement is needed to reach full speed.

The Reverse Throw can also be set interactively with the user actually deflecting the joystick. See *Interactive Setting Explained*.

---

### 7.20 JOYSTICK LEFT THROW - (LEFT THROW)

This sets the amount of left movement of the joystick that is required to reach full left turning speed. This is particularly useful for users with limited hand movement.

The programmable range is 25% to 100% in steps of 1%.

The percentage value corresponds to the amount of joystick deflection required to reach full left turning speed. For example, if set to 50%, then only half joystick movement is needed to reach full speed.



The Left Throw can also be set interactively with the user actually deflecting the joystick. See *Interactive Setting Explained*.

## 7.21 JOYSTICK RIGHT THROW - (RIGHT THROW)

This sets the amount of right movement of the joystick that is required to reach full right turning speed. This is particularly useful for users with limited hand movement.

The programmable range is 25% to 100% in steps of 1%.

The percentage value corresponds to the amount of joystick deflection required to reach full right turning speed. For example, if set to 50%, then only half joystick movement is needed to reach full speed.

The Right Throw can also be set interactively with the user actually deflecting the joystick. See *Interactive Setting Explained*.

### INTERACTIVE SETTING EXPLAINED

Setting the joystick throw interactively can only be achieved using OBP or a DTT.

To navigate and make selections in OBP use the joystick, deflecting it left, right, up and down as required. When a menu item is highlighted deflect the joystick to the right to enter.

If an item name is abbreviated then deflecting the joystick to the left will display its full name. A second deflection to the left will exit the current screen.

Once a parameter has been selected using the Speed Up and Speed Down buttons on the JSM's keypad will effect changes, unless an on screen message details otherwise.

To set Throw Interactively using OBP use the following procedure:

- Enter OBP and select Controls.
- From the Controls Menu select Joystick.
- From the Joystick Menu select Active Throw.
- From the Throw Menu set which Profiles will be affected by the interactive setting. This is achieved by placing a tick next to the Profiles required and a cross by the Profiles not required. Use the Speed Up and Down buttons to change the setting.
- Once this is complete deflect the joystick to the right while any of the Profiles are Highlighted. This will enter the Interactive Throw programming procedure.
- Follow the on-screen instructions
- After the Right direction has been set the R-net will go through a configuration process, an hourglass will be displayed during this time.
- Once the configuration is complete a large tick will be displayed on the screen for a short time and then the Joystick Menu will be displayed.

## 7.22 JOYSTICK DEADBAND - (DEADBAND)

This sets the size of the joystick's neutral area. In other words, how far the joystick has to be deflected before the brakes are released and drive commences.

The programmable range is 10% to 50% in steps of 1%. A normal setting is 10%.



## 7.23 INVERT FWD REV JS AXIS, INVERT LEFT RIGHT JS AXIS & SWAP JOYSTICK AXIS - (INVERT F/R, INVERT L/R & SWAP AXES)

These three parameters are closely related, so are covered in one section. The parameters allow eight different joystick direction configurations, or orientations. For example, it may be required that the joystick has to be pulled in reverse to effect forward drive. In this instance, it would simply be a case of setting Invert Fwd Rev JS Axis to Yes, however, there are many other combinations and these are best explained in the form of a table.

Required Orientation				Required Programming		
Forward	Reverse	Left	Right	Invert F/R	Invert L/R	Swap Axis
Forward	Reverse	Left	Right	No	No	No
Reverse	Forward	Left	Right	Yes	No	No
Forward	Reverse	Right	Left	No	Yes	No
Reverse	Forward	Right	Left	Yes	Yes	No
Left	Right	Reverse	Forward	No	No	Yes
Left	Right	Forward	Reverse	Yes	No	Yes
Right	Left	Reverse	Forward	No	Yes	Yes
Right	Left	Forward	Reverse	Yes	Yes	Yes

## CONTROLS – PROFILED

### 7.24 CHANGE MODE WHILE DRIVING - (CMID)

This sets whether Mode changes are permitted while the wheelchair is driving.

The programmable options are Yes and No.

### 7.25 SLEEP TIMER - (SLEEP)

This sets the period of joystick (or other type of Input Device) inactivity before the system will automatically power down.

The programmable range is 0 minutes to 30 minutes in steps of 1 minute. If set to a value of 0, then the system will never automatically power-down.

## STANDBY OPERATION EXPLAINED

Standby Mode provides a means for the user to select Profile and Modes without using switches or buttons. This is achieved by using joystick deflections to select and enter Profiles and/or Modes.

There are two ways to enter Standby Mode. These are set by the parameters, Standby Time and Switch to Standby, and are explained below.

While in Standby Mode, the operation of the joystick is set by the parameters, Mode Selection in Standby, Standby Forward, Standby Reverse, Standby Left, Standby Right and Remote Selection. Each is explained below.



## 7.26 STANDBY TIME - (SBYTM)

This sets a period of time of joystick inactivity before Standby Mode is entered.

The programmable range is 0 to 200 seconds. A value of 0 means that Standby Mode will never be entered.

## 7.27 SWITCH TO STANDBY - (SWSBY)

This sets whether a switch connected into the External Profile Switch Jack can be used to enter Standby Mode.

The programmable options are Yes and No.

If set to Yes, an external switch can be used to enter Standby Mode.

If set to No, Standby Mode cannot be entered with an external switch.

## 7.28 MODE SELECTION IN STANDBY - (MDESL)

This sets whether the joystick can be used to enter different operating Modes while the system is in Standby Mode, or whether Standby Mode is effectively a power-down condition.

The programmable options are Yes or No.

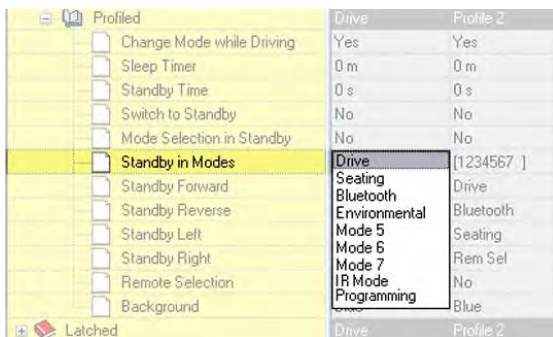
If set to Yes, then STANDBY will be displayed on the screen and joystick deflections can be used to select different operating Modes. Each of the four joystick directions can be programmed to enter a different Mode. This is set by Standby Forward, Standby Reverse, Standby Left and Standby Right.

If set to No, then STANDBY ON will be displayed on the screen and joystick deflections have no effect. To resume normal operation the Profile Button or an External Profile Switch, if fitted, should be operated.

## 7.29 STANDBY IN MODES

This allows the Standby function to be disabled in particular operating Modes. A typical example is if the R-net is being used to control a PC mouse. In this instance Standby would be undesirable as the joystick is likely to be frequently left in the center position for a period longer than that set by Standby Time.

The programmable options are in the form of a drop-down menu, as shown in the following diagram.



To set whether Standby is enabled in a particular Mode or Modes, simply highlight the appropriate menu item. Any combination of Modes can be selected.

When the drop down menu is closed the selected Modes are expressed as numbers and the parameter appears on the screen as below. The numbers 1 to 8 refer to the Modes listed in the menu.





Mode Selection in Standby	No	No	No	No	No	No	No	No
Standby in Modes	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]
Standby Forward	Drive	Drive	Drive	Drive	Drive	Drive	Drive	None

Example, if Standby is required in Drive and Seating Modes, the following selections should apply.

Profiled	Drive	Profile 2
Change Mode while Driving	Yes	Yes
Sleep Timer	0 m	0 m
Standby Time	0 s	0 s
Switch to Standby	No	No
Mode Selection in Standby	No	No
Standby in Modes	Drive	[1234567 ]
Standby Forward	Seating	Drive
Standby Reverse	Bluetooth	Bluetooth
Standby Left	Environmental	Bluetooth
Standby Right	Mode 5	Seating
Remote Selection	Mode 6	Rem Sel
Background	Mode 7	No
	IR Mode	Blue
	Programming	

When the drop down menu is closed, it would appear as below.

Mode Selection in Standby	No	No	No	No	No	No	No	No
Standby in Modes	[12 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]	[1234567 ]
Standby Forward	Drive	Drive	Drive	Drive	Drive	Drive	Drive	None

#### NOTE:

If a Mode is disabled using Standby in Modes and Standby Time is used to reach a Standby condition, the user must be able to operate either the JSM Mode button or a switch connected to the External Profile Switch Jack to return to Standby.

### 7.30 STANDBY FORWARD

This sets which Mode is entered when the joystick is deflected forwards while the system is in Standby Mode. Note, Mode Select in Standby must be set to Yes for this function to be active.

The programmable options are a list of Modes in a drop-down menu. Only one Mode can be selected from the menu.

### 7.31 STANDBY REVERSE

This sets which Mode is entered when the joystick is deflected in reverse while the system is in Standby Mode. Note, Mode Select in Standby must be set to Yes for this function to be active.

The programmable options are a list of Modes in a drop-down menu. Only one Mode can be selected from the menu.

### 7.32 STANDBY LEFT

This sets which Mode is entered when the joystick is deflected to the left while the system is in Standby Mode. Note, Mode Select in Standby must be set to Yes for this function to be active.

The programmable options are a list of Modes in a drop-down menu. Only one Mode can be selected from the menu.

### 7.33 STANDBY RIGHT

This sets which Mode is entered when the joystick is deflected to the right while the system is in Standby Mode. Note, Mode Select in Standby must be set to Yes for this function to be active.

The programmable options are a list of Modes in a drop-down menu. Only one Mode can be selected from the menu.





### 7.34 REMOTE SELECTION - (REMSL)

This sets whether Profiles and Modes can be selected and entered with joystick deflections.

The programmable options are Yes or No.



If set to Yes, then Remote Selection Mode can be entered from the Profile. Entry to Remote Selection Mode is via Standby Mode, the Profile Button or an External Profile Switch. The Profile will also be selectable from Remote Selection Mode.

If set to No, then Remote Selection Mode cannot be entered from the Profile, nor can the Profile be selected from Remote Selection Mode.

In Remote Selection Mode, any other Profile that has Remote Select set to Yes can be selected and entered. The screen display will be as above.

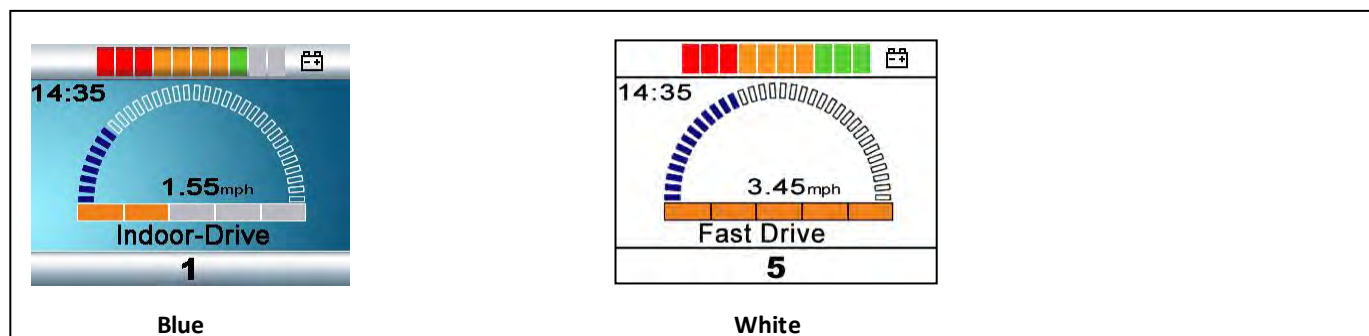
Profiles can be selected with left and right joystick deflections. When the desired Profile or Mode is selected, it can be entered with a forward deflection of the joystick.

If the standby timer expires while the system is in Remote Selection Mode, the Standby Mode will be re-entered and the original Profile will still apply.

### 7.35 BACKGROUND

This sets the LCD screen background color for each Profile.

The programmable options are Blue and White. Blue is the conventional setting, while White sets a high-contrast screen that may be more easily viewable in very bright conditions. The diagram below shows examples of the two screen types.



Inputs Devices that have color LCD screens have their own local programming for background, which can be set to Blue, White and Auto. If set to Blue or White, then those settings will always occur, but if set to Auto then the setting as determined by this parameter will occur.



---

## CONTROLS – SPEED PADDLES

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### 7.36 SPEED PADDLE OPERATION

This sets whether speed adjustment is via a momentary or continuous operation of the CJS2's Speed Paddle.

The programmable options are Momentary and Continuous.

If set to Momentary, the speed setting change occurs upon the initial deflection, rather than on the release) the Speed Paddle will adjust the speed setting by the programmed value of parameter Speed Step Size.

If set to Continuous, while the Speed Paddle is held deflected the speed setting will change by the programmed value of parameter Speed Step Size at a rate defined by the programmed value of parameter Speed Step Rate.

---

### 7.37 SPEED STEP SIZE

This sets by how much the speed setting will change when the CJS2's Speed Paddle is operated.

The programmable range is 1% to 80% in steps of 1%.

The term operation is defined by the programmed setting of parameter Speed Paddle Operation.

If that parameter is set to Momentary, then an operation is a single deflection of the Speed Paddle.

If that parameter is set to Continuous, then an operation is a continuous deflection of the Speed Paddle for the programmed value of parameter Speed Step Rate, and will auto-repeat.

---

### 7.38 SPEED STEP RATE

This sets the rate at which speed setting changes occur when the Speed Paddle is deflected.

The programmable range is 0.02 to 5.00 seconds in steps of 0.02 seconds.

This parameter is only effective when parameter Speed Paddle Operation is set to Continuous.

---

### 7.39 SPEED WRAP TIME

This sets a time delay between the speed setting wrapping from maximum to minimum. The purpose is to prevent inadvertent wraps, i.e. the user accidentally 'overshooting' the maximum speed setting.

The programmable range is 0 to 30 seconds in steps of 1 second. If set to 0, then no wrapping will occur.

---

### 7.40 SPEED WRAP DELAY

This sets a time delay after a wrap before the speed setting increases from the minimum level.

The programmable range is 1 to 10 seconds in steps of 0.5 seconds.

---

### 7.41 SPEED WRAP BEEP

This sets whether there is an audible beep when the CJS2's speed setting wraps from maximum to minimum.

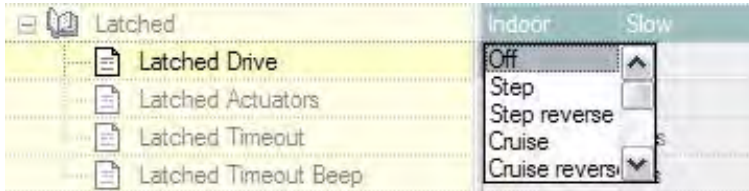
The programmable options are Yes and No.

## 8 LATCHED

### 8.1 LATCHED DRIVE - (DRIVE)

This sets the type of latched drive of the wheelchair.

The programmable options are in the form of a drop-down menu as shown in the following diagram.



If set to Off, there will be no latched drive.

If set to Step, the latched drive will be step type, but in the forwards direction only.

If set to Step reverse, the latched drive will be step type in both forwards and reverse.

Stepped drive is when short deflections of the joystick step up or down the latched drive speed of the wheelchair.

If set to Cruise, the latched drive will be cruise type, but in the forwards direction only.

If set to Cruise reverse, the latched drive will be cruise type in both forwards and reverse.

Cruise drive is when the wheelchair accelerates while the joystick is deflected, then, when the joystick is released the drive continues at the achieved speed.

#### NOTE:

If any Profile has latched drive set, then an Emergency Stop Switch must be fitted to the system via the Profile jack socket on the Joystick Module. If it is required for the system to operate without an Emergency Stop switch, this can be achieved via the parameter, Emergency Stop Switch.

#### WARNING:

Curtiss-Wright accepts no liability for losses of any kind resulting from the use of a wheelchair with latched drive or actuator operation and with no normally closed Emergency Stop Switch fitted.

### 8.2 LATCHED ACTUATORS - (ACTS)

This sets whether the seating functions are latched in operation.

The programmable options are Yes and No.

If set to Yes, then seating control will be latched in operation. i.e. a short joystick deflection will start seat movement.

If set to No, then the seating control will not be latched in operation.

#### NOTE:



If any Profile has latched actuators set, then an Emergency Stop Switch must be fitted to the system via the Profile jack socket on the Joystick Module. If it is required for the system to operate without an Emergency Stop switch, this can be achieved via the parameter, Emergency Stop Switch.

**WARNING:**

Curtiss-Wright accepts no liability for losses of any kind resulting from the use of a wheelchair with latched drive or actuator operation and with no normally closed Emergency Stop Switch fitted.

### 8.3 LATCHED TIMEOUT - (TIME)

This sets the time-out period for latched drive and actuator control.

The programmable range is 0 to 250 Seconds in steps of 1 Second.

The time-out period is the maximum length of time the joystick can be in the neutral position before latched movement ceases. If the period is exceeded, the latched movement will stop. Time-out is therefore an important safety feature that will stop drive or actuator movement should the user be unable to stop the functions in the usual way. It is important that an appropriate time-out period is set.

If a value of 2 or less is set, then the time-out function is disabled. This value should only be used in exceptional circumstances and after all the risks have been fully assessed.

**WARNING:**

Curtiss-Wright accepts no liability for losses of any kind resulting from the use of a wheelchair with latched drive or actuator operation and with a Latched Timeout value of less than 2.

### 8.4 LATCHED TIMEOUT BEEP - (BLEEP)

This sets whether a beep occurs as the end of the time-out period approaches. The beep is a reminder to the user to give a joystick command to maintain the latched drive or actuator movement.

The programmable options are Yes and No.

If set to Yes, there will be a beep as the timeout period approaches.

If set to No, there will be no beep.

## 9 SEATING

### 9.0.1 SEATING MODULE ENABLED

This parameter sets whether a Power Module is compatible with an ISM or with a Seating Module.

The parameter options are Yes or No.



If set to Yes, the Power Module will be compatible with a Seating Module. This setting should also be used if it is intended to use an EL PM90 to drive a single actuator.

If set to No, the Power Module will be compatible with an ISM.

## ACTUATOR AXES EXPLAINED

An actuator axis means a particular function of seat control. An axis may involve just one actuator motor, for example, a simple seat lift; or an axis may involve multiple motors, for example, adjustment of both footrests simultaneously or an anti-shear reclines system. There are 6 actuator motor channels on the ISM and an axis can combine any number of these channels.

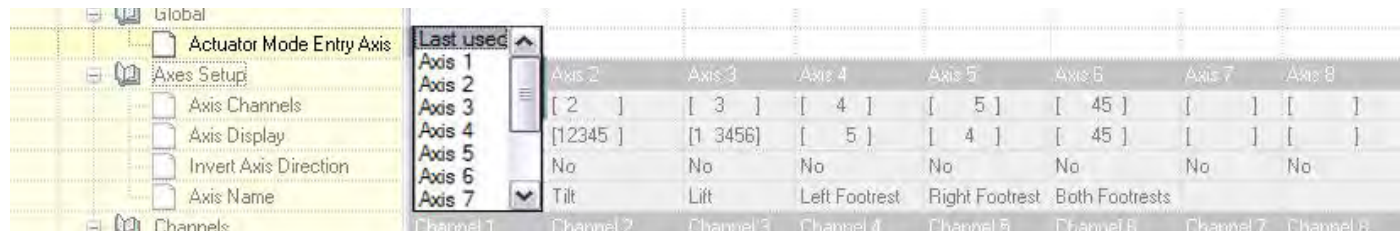
The R-net system can support up to 12 actuator axes. Each is programmable to define which actuator motors move and also how the user display appears. The relevant parameters are Axis Channels and Axis Display.

## INTELLIGENT SEATING MODULE – GLOBAL

### 9.1 ACTUATOR MODE ENTRY AXIS - (ACT. ENTRY AXIS)

This sets the actuator axis that is selected when Seating Mode is entered.

The programmable options are in the form of a drop-down menu, as shown in the following diagram.



Simply select the required axis. If Last used is selected, this means the axis that was selected on the last occasion Seating Mode was used will be the selected axis when Seating Mode is re-entered.

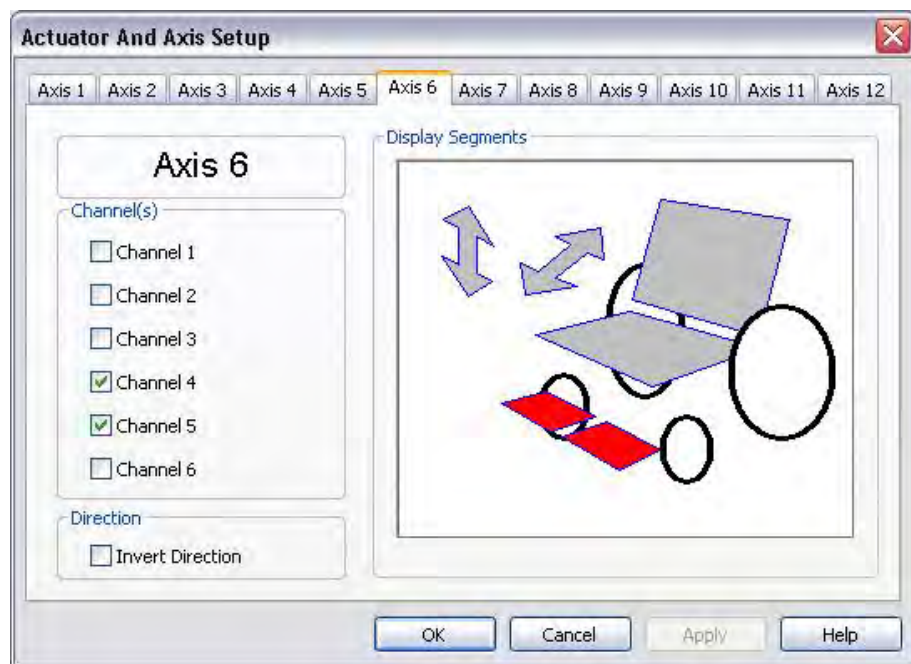
## INTELLIGENT SEATING MODULE - AXES SETUP

### 9.2 AXIS CHANNELS, AXIS DISPLAY, INVERT AXIS DIRECTION

These set:

- which actuator motor channels on the ISM will operate for a particular axis.
- the user display for a particular axis.
- whether a channel direction is inverted for a particular axis.

These options are in the form of a dialogue box, as shown in the following example diagram.



In this example, Axis 6 is the axis that is being set-up. With the programming as shown, Channels 4 and 5 will operate in this axis and the user display on the Joystick Module will highlight those areas colored in red.

#### NOTE:

The outline of the whole wheelchair symbol is always present on the user display, but with the elements highlighted as defined in red. However, if the arrow symbols are not defined in red, they will not appear on the display.

In this example, the axis direction is not inverted, i.e. when the joystick is deflected forwards, the channel outputs will have pin 2 positive with respect to pin 1.

When the dialogue box is closed, the programming is expressed as follows:

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Axis Channels	[ 1 ]	[ 2 ]	[ 3 ]	[ 4 ]	[ 5 ]	[ 45 ]	[ ]	[ ]
Axis Display	[ 1 ]	[12345 ]	[1 3456]	[ 5 ]	[ 4 ]	[ 45 ]	[ ]	[ ]
Invert Axis Direction	No	No	No	No	No	No	No	No
Axis Name	Backrest	Tilt	Lift	Left Footrest	Right Footrest	Both Footrests		

### 9.3 AXIS NAME

This parameter sets what text will be displayed on the LCD when the associated Actuator Axis is selected.

#### NOTE:

This is only applicable on Color Joystick Modules and the Omni.



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## INTELLIGENT SEATING MODULE – CHANNELS

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### 9.4 ACCELERATION - (ACC)

This sets the acceleration rate for a particular ISM channel.

Programmable range is 1 to 100 in steps of 1.

**WARNING:**

**This parameter must be set to 100% on systems that use automatic endstops, i.e. those that do not use micro-switches at the end of actuator travel. If the value is not set to 100%, then the automatic endstop function will not operate and damage to the actuator motor or the wheelchair frame may occur.**

---

### 9.5 DECELERATION - (DEC)

This sets the deceleration rate for a particular ISM channel.

Programmable range is 1 to 100 in steps of 1.

**WARNING:**

**This parameter must be set to 100% on systems that use automatic endstops, i.e. those that do not use micro-switches at the end of actuator travel. If the value is not set to 100%, then the automatic endstop function will not operate and damage to the actuator motor or the wheelchair frame may occur.**

---

### 9.6 UP SPEED - (UPSPD)

This sets the speed of a particular ISM channel in the Up direction.

Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Axis Direction is not set.

Programmable range is 25% to 100% in steps of 1%.

---

### 9.7 DOWN SPEED - (DNSPD)

This sets the speed of a particular ISM channel in the Down direction.

Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Axis Direction is not set.

Programmable range is 25% to 100% in steps of 1%.

---

### 9.8 UP CURRENT LIMIT

This sets the maximum current output for a particular ISM channel in the Up direction.

Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Axis Direction is not set.

The maximum current the ISM can deliver is 15A. However, this can only be achieved if the channel's Up Speed is less than 100%. At a setting of 100% speed, the maximum current is 12A. The actual speed setting that is required is dependent on the



electrical characteristics of the actuator motor being driven. Therefore, if currents of greater than 12A are required, the speed settings should be gradually reduced until reliable actuator movement is attained.

Programmable range is 1A to 15A in steps of 0.1A.

This parameter can be important if automatic endstop detection is employed. Automatic endstopping relies on the actuator mechanism being held against a firm mechanical stop at the end of travel. However, some mechanisms may distort over time due to the high endstop force. This force can be effectively reduced by reducing the value of this parameter.

**NOTE:**

**The value must not be set so low that it cannot move the maximum rated load for the actuator mechanism, or does not account for wear and increased friction in the mechanism.**

---

## 9.9 DOWN CURRENT LIMIT

This sets the maximum current output for a particular ISM channel in the Down direction.

Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Axis Direction is not set.

The maximum current the ISM can deliver is 15A. However, this can only be achieved if the channel's Down Speed is less than 100%. At a setting of 100% speed, the maximum current is 12A. The actual speed setting that is required is dependent on the electrical characteristics of the actuator motor being driven. Therefore, if currents of greater than 12A are required, the speed settings should be gradually reduced until reliable actuator movement is attained.

Programmable range is 1A to 15A in steps of 0.1A.

This parameter can be important if automatic endstop detection is employed. Automatic endstopping relies on the actuator mechanism being held against a firm mechanical stop at the end of travel. However, some mechanisms may distort over time due to the high endstop force. This force can be effectively reduced by reducing the value of this parameter.

**NOTE:**

**The value must not be set so low that it cannot move the maximum rated load for the actuator mechanism, or does not account for wear and increased friction in the mechanism.**

---

## 9.10 ENDSTOP AUTODETECT

This enables or disables the automatic endstop function for a particular actuator channel. Automatic endstop detection is a technique that uses actuator motor current to detect if an endstop has been reached. Upon detection, drive to the actuator motor is automatically cut. This technique removes the need for micro-switches at end limits.

The programmable options are Yes and No.

**NOTE:**

**Automatic endstop can only be used with actuator Acceleration and Deceleration values of 100%.**

**Automatic endstop may not work well if the actuator takes a very low current.**





## 9.11 ACTUATOR ENDSTOP TIMEOUT

This sets the amount of time the actuator motor current has to be above the endstop detection level (or actuator current limit if Endstop Autodetect is set to No) before the drive is cut. It is actually very rare to have to adjust this parameter, but it can be useful to prevent nuisance stopping, i.e. false detections of endstop.

The programmable range is 0 milliseconds to 500 milliseconds in steps of 10 milliseconds.

## 10 BATTERY

### 10.1 LOW BATTERY ALARM

This sets whether there will be an audible alarm to signal a low battery condition. The point at which the alarm will sound corresponds to the Low Battery Flash Level setting.

The programmable options are Yes and No.

### 10.2 LOW BATTERY FLASH LEVEL

This sets the point at which the battery gauge on the LCD screen starts to flash slowly to warn of a low battery condition.

The programmable range is 1 to 10 in steps of 1, and corresponds to the number of bars shown on the battery gauge. For example, if this value is set to 2, then the flashing will occur when the gauge drops to 2 bars.

### 10.3 CABLE RESISTANCE

This calibrates the system to compensate for the electrical resistance of the battery cable and connectors to the Power Module. This is necessary to ensure an accurate estimation of battery charge.

The programmable range is 0mOhms to 500mOhms in steps of 1mOhm.

The value should take into account the electrical resistance in both the positive and negative paths, including connectors.

### 10.4 CALIBRATION FACTOR

This allows further fine calibration of the battery gauge. This is normally set at the factory and should not need further adjustment.

### 10.5 LOW VOLTAGE CUT-OUT, LOW VOLTAGE TIME

These two parameters allow a low battery voltage cut-out function to be programmed. Such a function can be used to prevent over-discharge of the batteries.

If the battery voltage is below the value set by Low Voltage Cut-out for a period of time longer than that set by Low Voltage Time, then drive will be prevented. This will be recorded in the Power Module's error log.

Drive will then be permitted to resume when the battery voltage rises above the value of Low Voltage Cut-out.

The programmable range for Low Voltage Cut-out is 16V to 22V in steps of 0.5V.



The programmable range for Low Voltage Time is 1s to 255s in steps of 1s.

## 11 GENERAL

### 11.1 BRAKE DISCONNECTED ALARM

This sets whether there is an audible alarm when one or both of the brakes are disconnected from the Power Module.

The programmable options are Yes and No.

### 11.2 BRAKE FAULT DETECT

This sets whether the Power Module will detect electrical faults in the wheelchair's brakes or the connection to them.

The programmable options are Yes and No.

**WARNING:**

**This parameter should only ever be set to No if there are no electrical brakes fitted to the wheelchair.**

### 11.3 BRAKE VOLTAGE

This sets the voltage output from the Power Module to the wheelchair's electrical brakes.

The programmable options are 12V and 24V.

**WARNING:**

**It is essential the correct value for the brakes' operating voltage is set. An incorrect value could result in damage to the brakes or motors. Curtiss-Wright accepts no liability for losses of any kind resulting from incorrect programming of this parameter.**

### 11.4 SOFT STOP RATE

This sets the deceleration rate that is used while the wheelchair is "soft-stopping". "Soft-stopping" is if the system is powered-down while the wheelchair is being driven.

The programmable range is 0 to 200 in steps of 1.

If this value is the same or lower than the Forward Deceleration value, then the latter value will be used for "soft-stopping".

**WARNING:**

**It is the wheelchair manufacturer's responsibility to ensure that the wheelchair complies with the correct legislation for braking distances for the country in which the wheelchair is to be sold. Curtiss-Wright accepts no liability for losses of any kind resulting from incorrect programming of this parameter.**

### 11.5 SEAT REVERSAL



This can be used to set the R-net to function with wheelchairs that have a seat reversal function, i.e. the seat can be rotated to exchange the wheelchair configuration between front wheel drive and rear wheel drive. It is typical on such wheelchairs to have a micro-switch that signals which configuration the wheelchair is actually in. This micro-switch should be connected to the Inhibit2 input on the Power Module.

There are three programmable options – Never, Inhibit2 at 0V and Inh 2 at 0V - Profile mask active.

If set to Never, then the Inhibit2 input is not related to the seat reversal function.

If set to Inhibit2 at 0V and the Inhibit2 input is connected to 0V, then the wheelchair will be considered to be in a rear wheel drive configuration and the following conditions will apply.

The value of Front Wheel Drive Rate will be forced to 0 within the Power Module's software.

The Invert M1 Direction, the Invert M2 Direction and the Motor Swap parameters will be toggled within the Power Module's software

If set to Inhibit2 at 0V and the Inhibit2 input is not connected to 0V, then the wheelchair will be considered to be in a front wheel drive configuration and the following conditions will apply.

The programmed value of Front Wheel Drive Rate will apply.

The programmed settings of Invert M1 Direction, the Invert M2 Direction and the Motor Swap parameters will apply.

If set to Inh 2 at 0V - Profile mask active and the Inhibit2 input is connected to 0V, then the wheelchair will be considered to be in a rear wheel drive configuration and the following conditions will apply.

The value of Front Wheel Drive Rate will be forced to 0 within the Power Module's software.

The Invert M1 Direction, the Invert M2 Direction and the Motor Swap parameters will be toggled within the Power Module's software.

Only the Profiles that have Seat Reversal Profile set to Yes will be available.

If set to Inhibit2 at 0V and the Inhibit2 input is not connected to 0V, then the wheelchair will be considered to be in a front wheel drive configuration and the following conditions will apply.

The programmed value of Front Wheel Drive Rate will apply.

The programmed settings of Invert M1 Direction, the Invert M2 Direction and the Motor Swap parameters will apply.

Only the Profiles that have Seat Reversal Profile set to No will be available.

---

## 11.6 CHARGER INHIBIT 3 ENABLE

This should be set if it is intended to use the Inhibit3 input on the Power Module as an On-Board Charger (OBC) connection.

The programmable options are Off, High to Drive and Low to Drive.

If set to Off, then inhibit3 is not used as a Charger inhibit.

If set to High to Drive, Drive is inhibited when in Band 0.

If set to Low to Drive, Drive is inhibited when in Band 3.

### NOTE:

**Regardless of the setting of this parameter, the Inhibit 3 input can still be used as a multi-state input to provide speed limits and/or actuator inhibits. See section 13, Inhibits, for more details.**



---

### 11.7 CHARGER INHIBIT 3 LATCHING

This sets whether the On-Board Charger inhibit, which is located in the 3-way charger socket on the Power Module is latching or non-latching.

Latching means that power must be cycled after the inhibit is removed, in order to resume normal operation.

Non-latching means that normal operation will resume immediately the inhibit is removed.

The programmable options are Yes and No.

If set to Yes, the operation is latching.

If set to No, the operation is non-latching.

#### NOTE:

**Regardless of the setting of this parameter, the Inhibit 3 input can still be used as a multi-state input to provide speed limits and/or actuator inhibits. See section 13, Inhibits, for more details.**

---

### 11.8 CHARGER INHIBIT 1 LATCHING

This sets whether the Off-Board Charger inhibit, which is located in the 3-way charger socket on the Joystick Module is latching or non-latching.

Latching means that power must be cycled after the inhibit is removed, in order to resume normal operation.

Non-latching means that normal operation will resume immediately the inhibit is removed.

The programmable options are Yes and No.

If set to Yes, the operation is latching.

If set to No, the operation is non-latching.

---

### 11.9 CHARGER INHIBIT 1 ALARM

This sets whether an alarm sounds if there is a charge inhibit present on Inhibit 1.

A charge inhibit is invoked if an Off-Board Charger is connected into the 3-way charger socket on the Joystick Module.

The programmable options are On and Off.

---

### 11.10 CHARGER INHIBIT 3 ALARM

This sets whether an alarm sounds if there is a charge inhibit present on Inhibit 3.

A charge inhibit is invoked if an On-Board Charger is connected to the OBC connector on the Power Module and Charger Inhibit 3 Enable is set to Yes.



The programmable options are On and Off.

---

## GENERAL – FRONT WHEEL DRIVE

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### 11.11 FRONT WHEEL DRIVE TYPE

Front Wheel Drive Type selects specific specialist software for front wheel drive wheelchairs

If Front Wheel Drive Type A, this parameter electronically alters the shape of the joystick gate. This has the effect of damping the turning rate of the wheelchair between the 9 o'clock and 3 o'clock joystick positions.

If Front Wheel Drive Type is set to B, this parameter sets threshold which, if exceeded, then both forward and turn speeds are reduced, but the turning radius of the wheelchair remains unchanged. Type B can be used to increase the steerability of the wheelchair at speed.

---

### 11.12 FRONT WHEEL DRIVE

Front Wheel Drive adjusts the operation of the specialist software for Front Wheel Drive Wheelchairs.

This selects specialist software for front wheel driven wheelchairs.

The programmable range is 0% to 100% in steps of 1%.

If set to 0%, then “normal” software for rear wheel driven wheelchairs is employed.

If set to any other value then front wheel drive software is employed. A higher value makes the software more suitable for faster wheelchairs.

---

### 11.13 FWD ACCELERATION LIMIT

FWD Acceleration Limit sets the limit of forward acceleration when exiting a turn.

This limits the forward acceleration of the wheelchair when straightening out of a turn and helps prevent loss of traction.

The programmable range is 0% to 100%.

---

## GENERAL – ADVANCED ELECTRONIC STABILITY (AES)

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### 11.14 ADVANCED ELECTRONIC STABILITY

Advanced Electronic Stability sets whether the specialist stability software is turned on.

If set to On, AES detects if one wheel is running at a higher load and hence is running more slowly. If so, the speed of the other wheel is reduced accordingly to compensate for any steering offset.

AES can be used to minimize front wheel drive spins, fish-tailing and veering, both on the level and on a camber. The overall effect is to compensate for the wheelchair's centre-of-gravity being shifted from the axis of the drive wheels, as is the case on front wheel drive chairs.

If set Off, then the function is disabled.



### 11.15 AES RATE

AES Rate sets the rate of adjustment of Advanced Electronic Stability.

This sets the rate of adjustment between the wheels under uneven loads. The recommended value is 55% and should not be adjusted without consulting Curtiss-Wright.

A lower value will increase the strength of AES, which could result in the wheelchair feeling “twitchy” on turns.

The overall programmable range is 40% to 100%.

## 12 MOTOR

### MOTOR – GLOBAL

#### 12.1 MAXIMUM CURRENT LIMIT, BOOST DRIVE CURRENT, BOOST DRIVE TIME

These three parameters set the maximum current output from the Power Module. They are closely related, so are detailed in one section.

Maximum Current Limit sets the long-term maximum current output of the Power Module.

The programmable range is from 50A to 60A on a PM60, 50A to 80A on a PM80 or ELPM90 and 50A to 100A on a PM120, in steps of 1A.

Boost Drive Current sets the short-term maximum current output of the Power Module.

The programmable range is from the setting of Maximum Current Limit to: 60A on a PM60, 80A on a PM80, 90A on an ELPM90 and 120A on a PM120, in steps of 1A.

Boost Drive Time sets the period of time that the level of current set by Boost Drive Current is available.

The programmable range is from 0 Seconds to 10 Seconds in steps of 1 Second.

The following graph shows the relationship between the parameters.





There are maximum permissible values, which must not be exceeded, for each of these parameters. These values are shown in the table below.

	PM60	PM80	PM90	PM120
Maximum Current Limit	60 Amps	80 Amps	80 Amps	100 Amps
Boost Drive Current	60 Amps	80 Amps	90 Amps	120 Amps
Boost Drive Time	- -	- -	10 Secs	10 Secs

**WARNING:**

The values in the table above should never be exceeded. Doing so will invalidate the warranty and affect the long-term reliability of the Power Module.

## 12.2 CURRENT FOLDBACK THRESHOLD, CURRENT FOLDBACK TIME, CURRENT FOLDBACK LEVEL

These three parameters can be used to protect the wheelchair motors from overheating. The parameters are closely related, so are dealt with in one section.

Current Foldback Time sets a period of time, which if exceeded by the software timer will initiate a reduction in the Power Module's maximum current output.

The programmable range is 0 Seconds to 250 Seconds in steps of 1 Second.

Current Foldback Level sets the level of current output reduction, as a percentage of Maximum Current Limit, that will result.

The programmable range is 25% to 100% in steps of 1%.

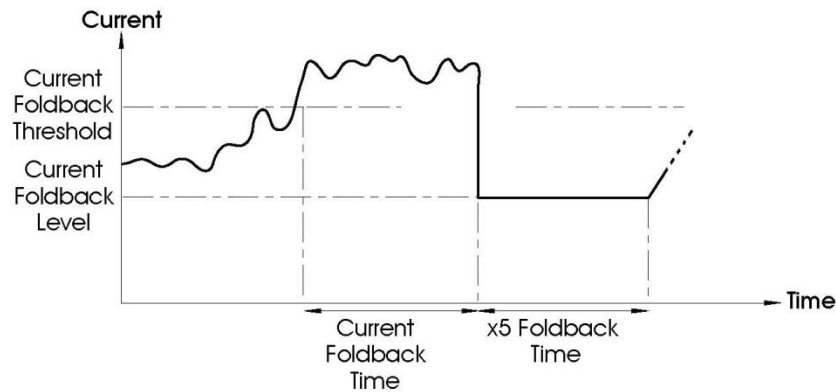
Current Foldback Threshold sets a level of current, which, if exceeded, will start a software timer running.

If the current drops below the level set by current foldback threshold, then the software timer will decrement each second.

The programmable range is 10A to Maximum Current Limit (see previous section) in steps of 1A.

After the reduction has occurred, the maximum current output will remain at the reduced level for a period of 5 times Current Foldback Time. This is a typical period that is sufficient to allow motors to cool.

The graph following shows the relationship between the parameters.



Example:            Maximum Current Limit is set to 80A            Current Foldback Threshold is set to 50A  
                          Current Foldback Time is set to 20 Seconds            Current Foldback Level is set to 50%

If the motor current is above 50A for a period of 20 Seconds, then it will reduce to 50% of 80A = 40A. It will then remain at this reduced level for 5 x 20 Seconds = 100 Seconds.

### 12.3 COMPENSATION

This matches the Power Module to the motors used on the wheelchair. This is necessary to achieve optimal performance and control, especially on a gradient.

The programmable range is 0mOhms to 500mOhms in steps of 5mOhms.

Curtiss-Wright recommend this value is initially set to 70% of the total resistance of the motor's armature, and all the connectors and cables between the motor and the Power Module motor output. Motor manufacturers should be able to supply a figure for the motor's armature resistance and typical connector and cables may be around 40mOhm.

Example:            The motor has a specified armature resistance of 100mOhms, and cables and connectors between the motor and the Power Module are estimated to be 40mOhm. This gives a total value of 140mOhm. The value of Compensation should therefore be set to 70% of 140mOhm = 100mOhm.

Once this value has been programmed, some drive testing should be carried out.

First of all, check that the wheelchair is controllable and comfortable to drive on a smooth, level surface. If it is not, then the value of Compensation may be too high and should be reduced.

Then drive the wheelchair towards a gradient at a very low speed, perhaps 10%. There should be no reduction in speed as the wheelchair climbs the gradient. If the speed drops or the wheelchair stops, then the value of Compensation may be too low and should be increased.

As a final check, drive the wheelchair up a gradient at full speed and release the joystick. The wheelchair should come to a smooth, complete stop and should not roll back before the brakes are applied. If the wheelchair does roll back, then try increasing the value of Compensation slightly. If the wheelchair appears to drive slightly up the gradient before the brakes are applied, then the value of Compensation should be reduced slightly.

All these tests should be conducted when the motors are cold and hot.

#### **WARNING:**

**These tests should be conducted in an open space and a restraining device such as a seat belt should always be used.**





The wheelchair manufacturer is responsible for ensuring that the value of Compensation is correctly set for the motors being used on the wheelchair. This is particularly important if replacement motors are being sent out to upgrade a wheelchair already in the field. Failure to comply with this requirement may result in poor control characteristics, which in extreme instances can make a wheelchair uncontrollable and potentially unsafe.

The wheelchair manufacturer is responsible for always ensuring that any replacement motors supplied as spare parts are fully compatible with the originals that the system was programmed to match. Failure to comply with this requirement may result in poor control characteristics, which in extreme instances can make a wheelchair uncontrollable and potentially unsafe.

A control system must not be moved from one wheelchair type to another without first ensuring that the system is correctly programmed for the wheelchair it is intended to fit it to. Even if control systems have the same Curtiss-Wright part number, they may not be programmed the same. Failure to ensure the system is correctly programmed for the wheelchair may result in a hazardous condition.

Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with any of these conditions.

---

#### 12.4 INVERT M1 DIRECTION

This inverts the direction of rotation of motor channel M1 on the Power Module. If the parameter, Motor Swap, is set to No, then channel M1 drives the left motor.

The programmable options are Yes or No.

If set to Yes, then when the joystick is deflected forwards, M1+ pin will be positive with respect to M1- pin.

If set to No, then when the joystick is deflected forwards, M1+ pin will be negative with respect to M1- pin.

---

#### 12.5 INVERT M2 DIRECTION

This inverts the direction of rotation of motor channel M2 on the Power Module. If the parameter, Motor Swap, is set to No, then channel M2 drives the right motor.

The programmable options are Yes or No.

If set to Yes, then when the joystick is deflected forwards, M2+ pin will be positive with respect to M2- pin.

If set to No, then when the joystick is deflected forwards, M2+ pin will be negative with respect to M2- pin.

---

#### 12.6 MOTOR SWAP

This swaps the motor output channels, M1 and M2, of the Power Module.

The programmable options are Yes or No.

If set to Yes, then channel M1 drives the right motor and channel M2 drives the left motor.

If set to No, then channel M1 drives the left motor and channel M2 drives the right motor.

---

#### 12.7 STEER CORRECT

This parameter compensates for any mis-match in motor speeds, thereby ensuring the wheelchair drives in a straight line when the joystick is being pushed directly forward. This is particularly useful for switch type Input Devices.

The programmable range is -9 to 9 in steps of 1.



If the wheelchair is veering to the left, then the values should be increased. Conversely, if the wheelchair is veering to the right, then the values should be decreased.

**NOTE:**

**This logic may be affected by the setting of parameter, Motor Swap, which, if set to Yes, will reverse the logic.**

---

## 12.8 DISPLAY SPEED - (DISPLAY SPEED)

This sets whether the speedometer is displayed in miles per hour or kilometers per hour. Note, the Power Module always calculates and transmits speed information in miles per hour.

The programmable options are Off, mph or km/h.

If set to Off, there will be no speed or odometer is displayed on the LCD screen.

If set to mph, then the speed and distance will be displayed as the value transmitted by the Power Module (which always sends the information in miles per hour) and the text 'mph' will appear on the LCD screen.

If set to km/h, then the module with the speed and odometer display will convert the Power Module value into kilometers per hour and the text 'km/h' will appear on the LCD screen.

**NOTE:**

**Only certain Input Devices, e.g. CJSM or Omni, have the speedometer and Odometer functions.**

---

## 12.9 DISPLAYS

Displays defines the format of the digital speed display. Displays can be programmed to Both, Speed or Odometer. If set to Both, the speed and trip distance are displayed on the screen. If set to either Speed or Odometer only the speed or trip distance will be displayed.

---

## 12.10 MAXIMUM RATED SPEED

This calibrates the speedometer and odometer functions. The value chosen should correspond to the speed of the wheelchair that is expected at a setting of Maximum Forward Speed = 100%. This value is always set in miles per hour.

The programmable range is 0.0mph to 20.0mph.

**NOTE:**

**Only certain Input Devices, e.g. CJSM or Omni, have the speedometer and odometer functions. If the parameter is set to zero the Speed and Odometer display will not be visible.**

---

## 12.11 MAXIMUM DISPLAYED SPEED (MAX DISPLAY SPEED)

This sets the operation of the graphical speed display, i.e. the blue semi-circle on the CJSM and Omni.

Ordinarily, the powerchair will be dispatched so that the graphical speed display reaches its maximum point at the maximum rated speed of the powerchair. This means that, if the powerchair is later programmed to a lower speed, to suit a particular user



for example, the graphical speed display would never reach its maximum. However, this can be compensated for by setting the value of Maximum Displayed Speed. This is best explained in an example.

A powerchair with a rated speed of 4mph requires the Maximum Forward Speed to be re-programmed from 100% to 80%, in order to suit a particular user. This would mean the powerchair now has a top speed of 3.2mph and that the graphical speed display will never 'fill' beyond a point of 80%. If it is required for the graphical speed display to 'fill' to 100%, then the value of Maximum Displayed Speed should be set to 3.2mph

The programmable range is 0.0mph to 20.0mph.

**NOTE:**

**Only certain Input Devices, e.g. CJSM or Omni, have the speedometer and Odometer functions.**

---

## 12.12 JOYSTICK STATIONARY TIME

If the joystick is held in a deflected position, i.e. away from center, for a period of time exceeding this value, then it is assumed the deflection is accidental and drive to the motors will be cut. This function is useful in avoiding motor damage in these situations.

The programmable range is 0 minutes to 60 minutes in steps of 1 minute. A setting of zero disables this function.

It is not normally necessary to adjust this parameter.

**WARNING:**

**The values of both Joystick Stationary Time and Joystick Stationary Range have been selected by the wheelchair manufacturer in order to minimize the risk of motor damage. Do not adjust these values with consulting the wheelchair manufacturer.**

**Curtiss-Wright accept no liability for losses of any kind resulting from the adjustment of the Joystick Stationary Time and Joystick Stationary Range parameters.**

---

## 12.13 JOYSTICK STATIONARY RANGE

This sets the 'window' within which the joystick is considered to be stationary. If the joystick moves by more than this value, then the associated timer is reset.

The programmable range is 1 to 50 in steps of 1.

It is not normally necessary to adjust this parameter.

**WARNING:**

**The values of both Joystick Stationary Time and Joystick Stationary Range have been selected by the wheelchair manufacturer in order to minimize the risk of motor damage. Do not adjust these values with consulting the wheelchair manufacturer.**

**Curtiss-Wright accept no liability for losses of any kind resulting from the adjustment of the Joystick Stationary Time and Joystick Stationary Range parameters.**



## MOTOR – PROFILED

### 12.14 COMPENSATION FACTOR

This allows different values of Compensation to be used across different profiles.

The programmable range is 0% to 200% in steps of 1%.

The programmed value adjusts the actual value of the parameter, Compensation.

For example, if Compensation was set to 100mOhms and Compensation Factor for a particular Profile was set to 150%, then an effective value of 150mOhms would be used for that Profile. Likewise, if in another Profile, Compensation Factor was set to 80%, then an effective value of 80mOhms would result.

See section, Compensation for details of how to set that parameter. Compensation must be set accurately before making adjustments to Compensation Factor.

#### **WARNING:**

**Inappropriate values of Compensation and Compensation Factor could make the wheelchair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind resulting from inappropriate setting of either or both of these parameters.**

## 13 INHIBITS

### INHIBITS EXPLAINED

Both the Power Module and the Intelligent Seating/Light Module (ISM) each have two Inhibit Inputs. On the Power Module, these are referred to as Inhibit 2 and Inhibit 3; and on the ISM, these are referred to as Inhibit 4 and Inhibit 5. For connection details of these inputs, please refer to the Installation Chapter.

Each of these inputs can recognize four different input conditions (or states). This means that four different events can originate from a single input. See the following Speed Inhibit and Actuator Inhibit Examples.

The state of an Inhibit input is defined as a percentage and is set by the resistance connected to the input.

If the input is connected directly to 0V, then it is considered to be at 0%.

If the input is connected to 0V via a 10KOhm resistor or greater, then it is considered to be at 100%.

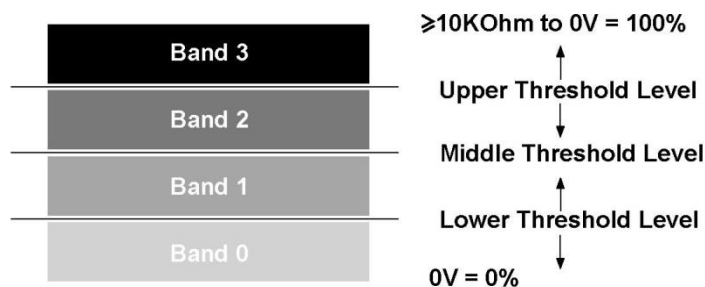
Each of the 99 steps between corresponds to 100Ohm. As an example, if the input is connected to 0V via a 4.7KOhm resistor, then the input is considered to be at 47%.

Dependent on the state of an input, it is in one of four bands. The size of these bands is programmable via the parameters Lower Level Threshold, Middle Level Threshold and Upper Level Threshold. These are shown in the following diagram.

Each of the Threshold Level parameters can be set between 0% and 100% in steps of 1%.

After the input bands have been defined, then each input can be linked to a speed limit or full drive inhibit via the parameters: Assign, Speed Limit in Band 0, Speed Limit in Band 1, Speed Limit in Band 2 and Speed Limit in Band 3.

Assign, Speed Limit in Bands 0, 1, 2 and 3 as Operation.



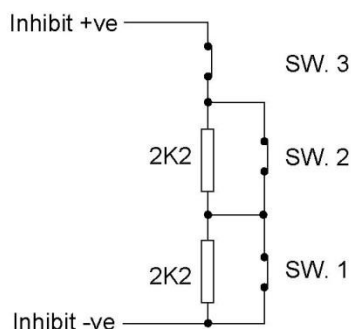
Each input can also be linked to an actuator function via the parameters: Assign, Channel x Up: Inhibit in Bands and Channel x Down: Inhibit in Bands.

### SPEED INHIBIT EXAMPLE

**Application:** A wheelchair with an elevating seat, whereby, when the seat is lowered, full speed drive is permitted. Then as the seat raises, 3 switches are operated, thereby changing the resistance connected to the input and giving, say, 50% speed limit to 25% speed limit to full drive inhibit.

In this example the Inhibit is connected to Inhibit2 input that is sited on the Power Module.

A circuit such as follows is used.



The Inhibit input must be assigned to a specific software Inhibit. As this is a speed inhibit, the parameter Drive Inhibits Assign should be used. Inhibit2 input is therefore assigned to Drive Inhibit A.

When the seat is in the fully lowered position, all switches are closed and the electrical resistance is a short-circuit or 0 Ohms. As the seat raises, SW1 opens giving 2.2KOhms, then SW2 opens giving 4.4KOhms and at full height SW3 opens giving a complete open-circuit.

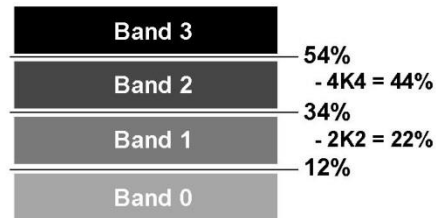
Programming would be as follows:

Inputs PM - Threshold Levels:	
Upper Level Threshold	54%
Middle Level Threshold	34%



Lower Level Threshold                      12%

This gives a band arrangement as follows.



As good practice, the threshold limits have been chosen so the actual resistance values that trigger a change are in the approximate center of the bands, thereby eliminating the risk of a system erroneously switching between bands.

The 4 Speed Limits for Drive Inhibit A would need to be set as below:

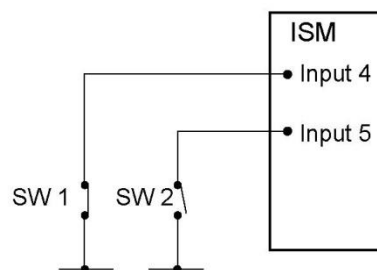
Inhibit A:

Speed Limit in Band 0	100%
Speed Limit in Band 1	50%
Speed Limit in Band 2	25%
Speed Limit in Band 3	0%

## ACTUATOR INHIBIT EXAMPLES

**Application 1:** A wheelchair is fitted with a reclining backrest that has endstop switches connected to the R-net's Inhibit inputs 4 and 5 on the ISM. In this example the switches are installed to be normally closed and the Backrest has been programmed to use Actuator Channel 2.

A circuit such as follows is used.

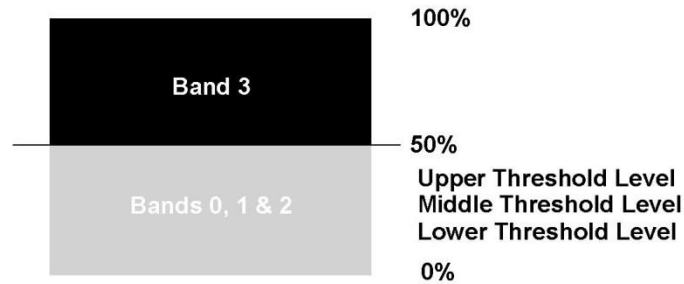


The Inhibit input must be assigned to a specific software Inhibit. As this is an Actuator Inhibit, the parameters Actuator Inhibits Channel X - Up: Assign & Down: Assign should be used.

The inputs are therefore assigned to Actuator Inhibits Channel 2 as follows:

Up: Assign - Input 4  
Down: Assign - Input 5

As these inputs are connected to the ISM the Threshold levels must be set in the parameter Inputs - ISM.



When Actuator Inhibits Channel 2 is programmed in the following way the inhibit will effectively stop the backrest actuator being moved in the Up direction when Switch 1 is open and in the Down direction when Switch 2 is open.

Up: Assign 4	Down: Assign 5
Inhibit in Band 0 no	Inhibit in Band 0 no
Inhibit in Band 1 no	Inhibit in Band 1 no
Inhibit in Band 2 no	Inhibit in Band 2 no
Inhibit in Band 3 yes	Inhibit in Band 3 yes

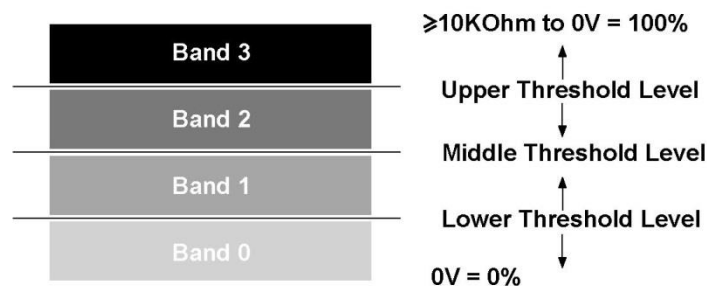
**Application 2:** A wheelchair is fitted with a reclining seat. It is required to offer a programmable angle of recline to suit different users. A potentiometer of maximum value 10KOhm is fitted to the recline mechanism and is connected to the R-net's Inhibit 4 input sited on the ISM. In this example the Backrest has been programmed to use Actuator Channel 3.

The Inhibit input must be assigned to a specific software Inhibit. As this is an Actuator Inhibit, the parameters Actuator Inhibits Channel 3 - Up: Assign & Down: Assign should be used.

The inputs are therefore assigned to Actuator Inhibits Channel 3 as follows:

Up: Assign - Input 4  
Down: Assign - Input 4

As these inputs are connected to the ISM the Threshold levels must be set in the parameter Inputs - ISM.



By programming the Actuator Channel 3 Up Inhibit and Actuator Channel 3 Down Inhibit parameters as below, it is possible to program the maximum angle of travel of the recline mechanism via the Inhibit 4.

Actuator Channel 3

Up: Assign 4	Down: Assign 4
Inhibit in Band 0 yes	Inhibit in Band 0 no
Inhibit in Band 1 no	Inhibit in Band 1 no
Inhibit in Band 2 no	Inhibit in Band 2 no
Inhibit in Band 3 no	Inhibit in Band 3 yes



This programming means that the Up movement will be inhibited when the Inhibit4 input is in Band 0, i.e. one end of recline travel, and that the Down movement will be inhibited when the Inhibit4 input is in Band 3, i.e. the other end of the recline travel. Referring the Band diagram above, it can be seen that by programming Inhibit4 Upper Level Threshold and Inhibit4 Lower Level Threshold, then the actual angular range of the recline mechanism is adjusted.

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## INHIBITS – GLOBAL

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### 13.1 DISABLE INHIBIT 2 IN DRIVE

This sets whether the PM Inhibit2 input is interrogated just at entry into Drive Mode or constantly during Drive Mode.

The programmable options are Yes and No.

If set to Yes, the input will only be interrogated at entry into Drive Mode. An example of when this function may be useful is if a tilt-sensor is used that could be inadvertently operated when driving over rough terrain. By employing this function, an inhibit will only be applied if Drive Mode is entered with the seat in a genuinely tilted position.

If set to No, the input will be interrogated constantly during Drive Mode, i.e. normal inhibit operation.

---

### 13.2 DISABLE INHIBIT 3 IN DRIVE

This sets whether the PM Inhibit3 input is interrogated just at entry into Drive Mode or constantly during Drive Mode.

The programmable options are Yes and No.

If set to Yes, the input will only be interrogated at entry into Drive Mode. An example of when this function may be useful is if a tilt-sensor is used that could be inadvertently operated when driving over rough terrain. By employing this function, an inhibit will only be applied if Drive Mode is entered with the seat in a genuinely tilted position.

If set to No, the input will be interrogated constantly during Drive Mode, i.e. normal inhibit operation.

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## INHIBITS - INPUTS – PM

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### 13.13 LOWER LEVEL THRESHOLD

This sets the level of the threshold between Band 0 and Band 1 for a particular Inhibit Input (Inhibit 2 or Inhibit 3) on the Power Module. See *Inhibits Explained* for more details on Power Module inhibits and Bands.

The programmable range is 0% to 100% in steps of 1%.

---

### 13.4 MIDDLE LEVEL THRESHOLD

This sets the level of the threshold between Band 1 and band 2 for a particular Inhibit Input (Inhibit 2 or Inhibit 3) on the Power Module. See *Inhibits Explained* for more details on Power Module inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

---

### 13.5 UPPER LEVEL THRESHOLD

This sets the level of the threshold between Band 2 and band 3 for a particular Inhibit Input (Inhibit 2 or Inhibit 3) on the Power Module. See *Inhibits Explained* for more details on Power Module inhibits and bands.





The programmable range is 0% to 100% in steps of 1%.

---

### 13.6 DEBOUNCE TIME

This sets a debounce time for the Inhibit input. Debounce is the amount of time the input must be stable before a new condition is registered. This is particularly useful if mercury switches are being employed and eliminates the effect of “splashing” across the contacts.

The programmable range is 0mS to 400mS in steps of 50mS.

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## INHIBITS - INPUTS – ISM

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### 13.7 LOWER LEVEL THRESHOLD

This sets the level of the threshold between Band 0 and Band 1 for a particular Inhibit Input (Inhibit 4 or Inhibit 5) on the ISM. See *Inhibits Explained* for more details on ISM inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

---

### 13.8 MIDDLE LEVEL THRESHOLD

This sets the level of the threshold between Band 1 and band 2 for a particular Inhibit Input (Inhibit 4 or Inhibit 5) on the ISM. See *Inhibits Explained* for more details on ISM inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

---

### 13.9 UPPER LEVEL THRESHOLD

This sets the level of the threshold between Band 2 and band 3 for a particular Inhibit Input (Inhibit 4 or Inhibit 5) on the ISM. See *Inhibits Explained* for more details on ISM inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

---

### 13.10 DEBOUNCE TIME

This sets a debounce time for the Inhibit input. Debounce is the amount of time the input must be stable before a new condition is registered. This is particularly useful if mercury switches are being employed and eliminates the effect of “splashing” across the contacts.

The programmable range is 0mS to 400mS in steps of 50mS.

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## INHIBITS - DRIVE INHIBITS

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### 13.11 ASSIGN

The R-net Power Module has five drive separate software Drive Inhibits. These are referred to as A, B, C, D and E; and each of these can be initiated by any actual hardware inhibit input in the system. This functionality means that speed limits or drive inhibits can be triggered from 5 individual sources.



The parameter, Assign, links the software inhibits to an actual hardware inhibit. For example, if Assign:A is set to 2, then the operation of Drive Inhibit A will be controlled via Inhibit Input 2, which is located on the Power Module. Alternatively, if Assign:A is set to 4, then the operation of Drive Inhibit A will be controlled via Inhibit Input 4, which is located on the Intelligent Seating/Lighting Module.

The programmable options are Off and 2 to 33.

If set to Off, then the relevant Drive Inhibit can never be active.

If set to a numeric value, then the relevant Drive Inhibit will be under the control of the Inhibit Input that corresponds to that number. Inhibit Inputs 2 and 3 are on the Power Module, Inhibits 4 and 5 are on the Intelligent Seating/Lighting Module, and Inhibits 6 to 33 will be on other Curtiss-Wright or third party modules.

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### 13.12 SPEED LIMIT IN BAND 0

This sets the maximum speed of the wheelchair when the Inhibit input, which is assigned to the Drive Inhibit, is in Band 0. See *Inhibits Explained* for more details on Power Module inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

If set to 0%, then a full drive inhibit will be effected and the wheelchair's brakes will not release. See also sections, Operation and Inhibit Alarm, below.

If set to between 1% and 100%, the value will correspond to the maximum possible speed the wheelchair can drive.

---

### 13.13 SPEED LIMIT IN BAND 1

This sets the maximum speed of the wheelchair when the Inhibit input, which is assigned to the Drive Inhibit, is in Band 1. See *Inhibits Explained* for more details on Power Module inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

If set to 0%, then a full drive inhibit will be effected and the wheelchair's brakes will not release. See also sections, Operation and Inhibit Alarm, below.

If set to between 1% and 100%, the value will correspond to the maximum possible speed the wheelchair can drive.

---

### 13.14 SPEED LIMIT IN BAND 2

This sets the maximum speed of the wheelchair when the Inhibit input, which is assigned to the Drive Inhibit, is in Band 2. See *Inhibits Explained* for more details on Power Module inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

If set to 0%, then a full drive inhibit will be effected and the wheelchair's brakes will not release. See also sections, Operation and Inhibit Alarm, below.

If set to between 1% and 100%, the value will correspond to the maximum possible speed the wheelchair can drive.

---

### 13.15 SPEED LIMIT IN BAND 3

This sets the maximum speed of the wheelchair when the Inhibit input, which is assigned to the Drive Inhibit, is in Band 3. See *Inhibits Explained* for more details on Power Module inhibits and bands. The programmable range is 0% to 100% in steps of 1%.



If set to 0%, then a full drive inhibit will be effected and the wheelchair's brakes will not release. See also sections, Operation and Inhibit Alarm, below.

If set to between 1% and 100%, the value will correspond to the maximum possible speed the wheelchair can drive.

---

### 13.16 OPERATION

This sets whether a full drive inhibit, i.e. 0% speed limit setting, is a latching or non-latching function.

The programmable options are Non-latching and Latching.

If set to Non-latching, then as soon as the signal that initiated the drive inhibit is removed, then drive can resume.

If set to Latching, then to resume drive after the signal that initiated the drive inhibit is removed, then the system power must first be cycled.

---

### 13.17 INHIBIT ALARM

This sets whether an audible alarm will sound in a full drive inhibit condition, i.e. speed limit setting of 0% is active.

The programmable options are Yes and No.

If set to Yes, then an alarm will sound while the full drive inhibit is present.

If set to No, then no alarm will sound.

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## INHIBITS - ACTUATOR INHIBITS

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### 13.18 CHANNEL X – UP: ASSIGN (X = 1 TO 6)

The R-net Intelligent Seating/Lighting Module has three separate software inhibits for the up direction of each of its output channels, 1 to 6. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Axis Direction is not set. These inhibits are referred to as A, B and C; and each can be initiated by any actual hardware input in the system. This functionality means that any actuator channel direction can be inhibited from 3 individual sources.

The parameter, Assign, links the software inhibits to an actual hardware inhibit. For example, if Assign: A is set to 4, then the operation of Channel x Up Inhibit will be controlled via Inhibit Input 4, which is located on the Intelligent Seating Module.

The programmable options are Off and 2 to 33.

If set to Off, then the relevant Channel x Up Inhibit can never be active.

If set to a numeric value, then the relevant Channel x Up Inhibit will be under the control of the Inhibit Input that corresponds to that number. Inhibit Inputs 2 and 3 are on the Power Module, Inhibits 4 and 5 are on the Intelligent Seating/Lighting Module, and Inhibits 6 to 33 will be on other Curtiss-Wright or third party modules.

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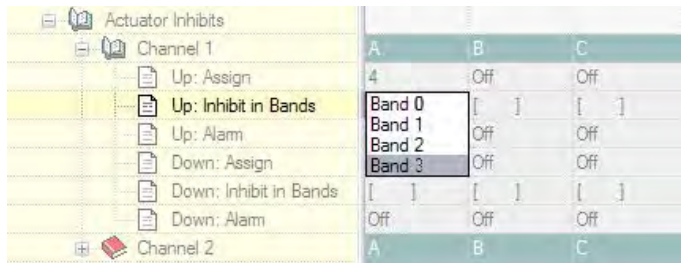
### 13.19 CHANNEL X – UP: INHIBIT IN BANDS (X = 1 TO 6)

This sets the condition of the input (assigned to Channel x Up Inhibit) that will result in an inhibit of the actuator drive in the up direction. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Axis Direction is not set. The inhibit can be set to occur in any combination of bands. See *13 Inhibits Explained* for more details on Bands.

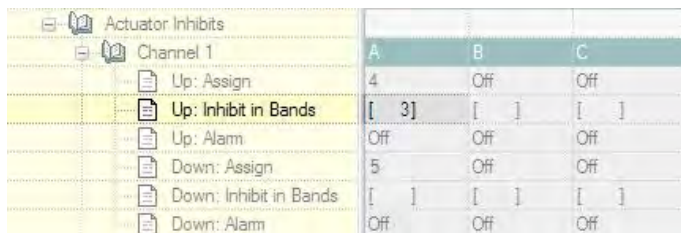
The programmable options are Band 0, Band 1, Band 2 and Band 3.



If the parameter is selected, then a drop down menu as below will appear and the bands required to invoke the inhibit should be selected. For example, if the inhibit is required for Band 3 only, then that option should be selected, as shown.



When the drop down menu is closed, it would appear as below.



### 13.20 CHANNEL X – UP: ALARM

This sets whether an audible alarm will sound when a channel's up direction is inhibited. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Axis Direction is not set.

The programmable options are On and Off.

If set to On, then an alarm will sound while an inhibit is present.

If set to Off, then no alarm will sound.

### 13.21 CHANNEL X – DOWN: ASSIGN (X = 1 TO 6)

The R-net Intelligent Seating/Lighting Module has three separate software inhibits for the down direction of each of its output channels, 1 to 6. Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Axis Direction is not set. These inhibits are referred to as A, B and C; and each can be initiated by any actual hardware input in the system. This functionality means that any actuator channel direction can be inhibited from 3 individual sources.

The parameter, Assign, links the software inhibits to an actual hardware inhibit. For example, if Assign:A is set to 4, then the operation of Channel x Down Inhibit will be controlled via Inhibit Input 4, which is located on the Intelligent Seating Module.

The programmable options are Off and 2 to 33.

The programmable options are Off and 2 to 33.

If set to Off, then the relevant Channel x Down Inhibit can never be active.

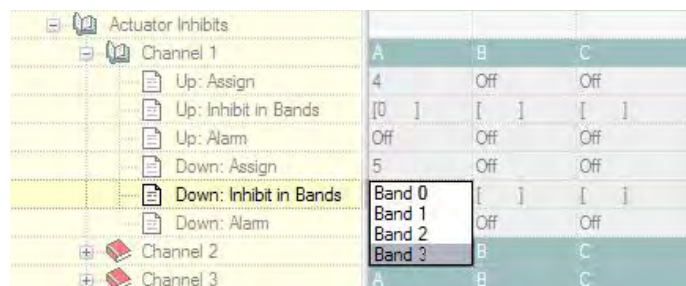
If set to a numeric value, then the relevant Channel x Down Inhibit will be under the control of the Inhibit Input that corresponds to that number. Inhibit Inputs 2 and 3 are on the Power Module, Inhibits 4 and 5 are on the Intelligent Seating/Lighting Module, and Inhibits 6 to 33 will be on other Curtiss-Wright or third party modules.

### 13.22 CHANNEL X – DOWN: INHIBIT IN BANDS (X = 1 TO 6)

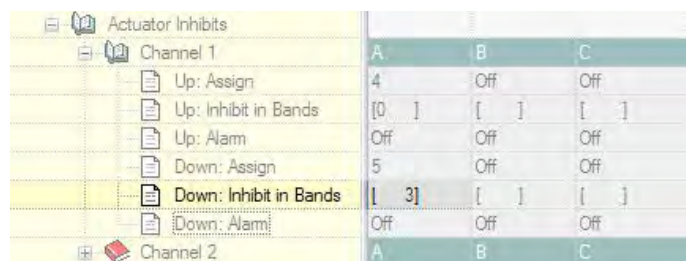
This sets the condition of the input (assigned to Channel x Down Inhibit) that will result in an inhibit of the actuator drive in the down direction. Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Axis Direction is not set. The inhibit can be set to occur in any combination of bands. See *13 Inhibits Explained* for more details on bands.

The programmable options are Band 0, Band 1, Band 2 and Band 3.

If the parameter is selected, then a drop down menu as below will appear and the bands required to invoke the inhibit should be selected. For example, if the inhibit is required for Band 3 only, then that option should be selected, as shown.



When the drop down menu is closed, it would appear as follows.



### 13.23 CHANNEL X – DOWN: ALARM

This sets whether an audible alarm will sound when a channel's down direction is inhibited. Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Axis Direction is not set.

The programmable options are On and Off.

If set to On, then an alarm will sound while an inhibit is present.

If set to Off, then no alarm will sound.

## 14 LIGHTS

### 14.1 LAMP VOLTAGE

This sets the operating voltage for the wheelchair's lighting system.

The programmable options are 12V and 24V. The wheelchair's light and indicators should be fitted with lamps of the corresponding value.

If set to 12V, then the lights and indicators will remain a constant brightness, whilst the battery voltage is above this level.



If set to 24V, then the brightness of the lamps and indicators will vary with fluctuations in the battery voltage.

**NOTE:**

**TÜV Germany requires the 12V constant brightness condition.**

---

## 14.2 INDICATOR FAULT DETECTION

This sets whether defective turn indicator lamps can be detected. The detection circuitry is looking for the presence of 2 x 21W lamps per side.

The programmable options are Yes and No.

If set to Yes, then if 2 x 21W lamps (per side) in working order are not connected to the Seating/Lighting Module, a turn indicator fault will be detected and indicated to the user (via a rapid flash of the relevant turn indicator on the Joystick Module).

If set to No, then the indicator fault detection circuitry will be turned off. This option should be used if 2 x 21W lamps (per side) are not being used for the turn indicators.

**NOTE:**

**TÜV Germany requires that 2 x 21W lamps per side are used for the turn indicators.**

---

## 14.3 SWAP INDICATORS SEAT REVERSAL

This sets whether the left and right turn indicator channels are exchanged when the seat is reversed. The seat is considered to be reversed when the Inhibit 2 input on the Power Module is at 0V. For more details on seat reversal, please refer to section, Seat Reversal.

The programmable options are Yes and No.

If set to Yes, then if the seat is reversed, the turn indicator left and right channels on the Seating/Lighting Module will be exchanged. This option should be used if the turn indicators are mounted on the wheelchair frame.

If set to No, then if the seat is reversed, the turn indicator left and right channels will be unaffected. This option should be used if the turn indicators are mounted on the wheelchair seat.

---

## 14.4 BRAKE LIGHTS OR HORN

This sets whether the brake light output on the Seating/Lighting Module is to be used for Brake lights or a Horn function.

The programmable options are Brake Light and Horn.

If set to Brake Light then the brake light function will be enabled.

If set to Horn, then the Horn function will be enabled.

---

### LED INDICATOR FAULT DETECTION EXPLAINED

LED's operate on current and their power usage is not constant or linear across the battery voltage range. The failure current will often vary non-linearly with battery voltage depending on the type of cluster.

To accurately detect led indicator failures for a particular led cluster the failure threshold across the complete voltage range should be defined. This is done by setting five fault current thresholds



#### 14.5 INDICATOR FAULT CURRENT 15V, INDICATOR FAULT CURRENT 20V, INDICATOR FAULT CURRENT 25V, INDICATOR FAULT CURRENT 30V & INDICATOR FAULT CURRENT 35V.

Because the current in LED clusters does not vary linearly with voltage, then in order to ensure reliable error detection of one cluster becoming disconnected error current thresholds must be defined for the entire operating range of the battery voltage. This is achieved with five programmable parameters – Indicator Fault Current XV – each with a programmable range of 0.00A to 1.00A in steps of 0.005A. These parameters set an error current threshold for a defined battery voltage with threshold at interim voltages being extrapolated between the programmed values. Examples of how to set the values for each parameter are given below.

##### INDICATOR FAULT CURRENT EXAMPLES

- Determine the current taken by the front LED cluster at supply voltages of 15V, 20V, 25V, 30V and 35V,
- Now repeat for the rear LED cluster.
- This second step is not necessary if front and rear clusters are of the same type.

Parameter	Programmable Range
Indicator Fault Current 15V	0 to 1A steps 0.005A
Indicator Fault Current 20V	0 to 1A steps 0.005A
Indicator Fault Current 25V	0 to 1A steps 0.005A
Indicator Fault Current 30V	0 to 1A steps 0.005A
Indicator Fault Current 35V	0 to 1A steps 0.005A

- Establishing the current levels can be achieved by; reading the LED's data sheet, the PC programmer status ISM window or by measurement using a variable voltage power supply.

If the front and rear LED

clusters are different, then the error current threshold should be set to:

$$\text{Higher LED current} + (\text{Lower LED current} / 2)$$

If the front and rear LED clusters are of the same model, then the error current threshold should be set to:

$$\text{LED current} + (\text{LED current} / 2)$$

Example 1:

The front and rear LED clusters are of different types and have voltage/current relationships as shown in the table below. The values of Indicator XV Fault Current are calculated using:

$$\text{Higher LED current} + (\text{Lower LED current} / 2)$$



Voltage	Front	Rear	Indicator XV Fault Current
15V	0.065A	0.180A	0.210A
20V	0.045A	0.155A	0.180A
25V	0.040A	0.125A	0.145A
30V	0.030A	0.115A	0.130A
35V	0.035A	0.100A	0.120A

**Example 2:**

The front and rear LED clusters are of the same types and have voltage/current relationships as shown in the table below. The values of Indicator XV Fault Current are calculated using:

$$\text{Higher LED current} + (\text{Lower LED current} / 2)$$

Voltage	Front	Rear	Indicator XV Fault Current
15V	0.180A	0.180A	0.270A
20V	0.150A	0.150A	0.225A
25V	0.120A	0.120A	0.180A
30V	0.110A	0.110A	0.165A
35V	0.100A	0.100A	0.150A

**NOTE:**

**Any temperature or production tolerance in the LED cluster current draw must also be taken into account when determining the fault current thresholds.**

## 15 OEM FACTORY

The parameters within the OEM Factory group allow the manufacturer to set a maximum and minimum programming area for a set of parameters. The set values create the new programmable range for the vehicles parameters which cannot be adjusted without the R-net PC Programmer OEM level.

Example: A standard range for parameter X is 1% to 100%

The Absolute X parameter is set at 15% min to 75% max

This means that anyone wishing to change parameter X from now on has only got an available range of 15 to 75%.

**WARNING:**

**It is the responsibility of the vehicle manufacturer, to ensure that adequate testing of the vehicle is carried out, to ensure that the values set will maintain vehicle stability and user safety. Curtiss-Wright accepts no liability for losses of any kind resulting from this parameter being incorrectly programmed.**

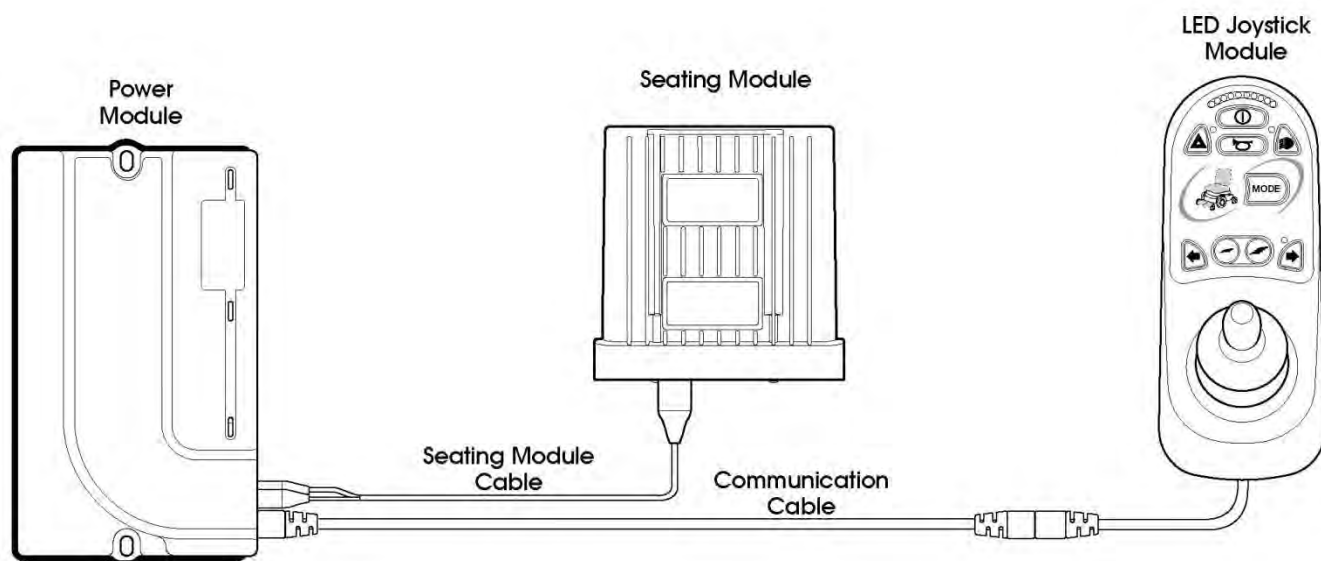


## CHAPTER 4 – ELPM 90, JSM-LED & SM

### 1 INTRODUCTION

This section describes the differences between the previous sections if any of the following modules are used. It is therefore important that all the previous sections have been read and understood.

JSM-LED	LED Joystick Module
JSM-LED-L	LED Joystick Module with lighting control buttons
EL PM90	EL 90A Power Module
SM	Seating Module



#### NOTE:

The EL PM90 can actually be used with any R-net JSM, including LCD based versions, as well as an Omni or any other Input Device.

The LED JSMs can actually be used with any R-net PM, ISM or any other Output Device.

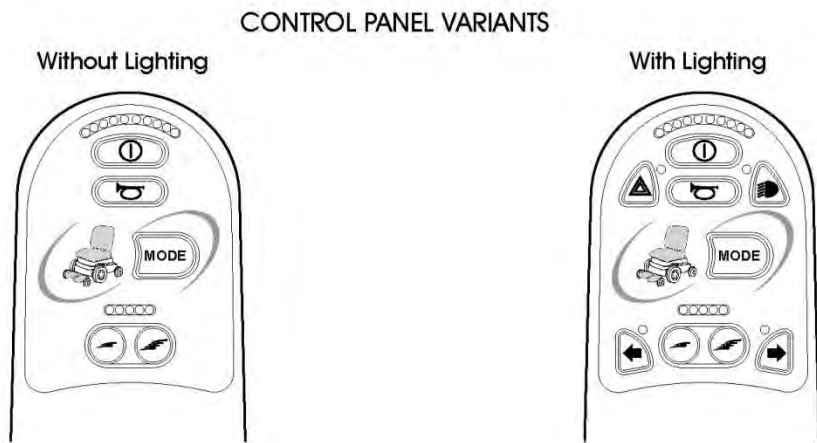
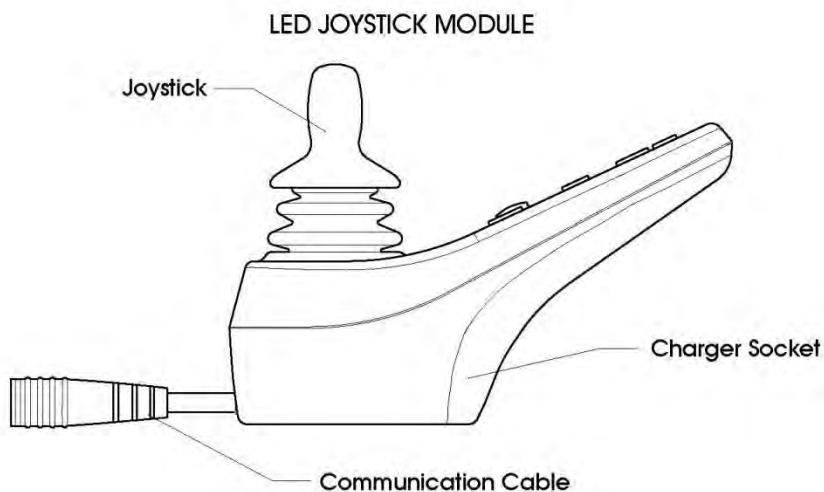
The SM can only be used with the EL PM90.

The JSM-Led should not be used for Latched drive operation, there is no facility to fit an E-stop switch to the LED Joystick Module.

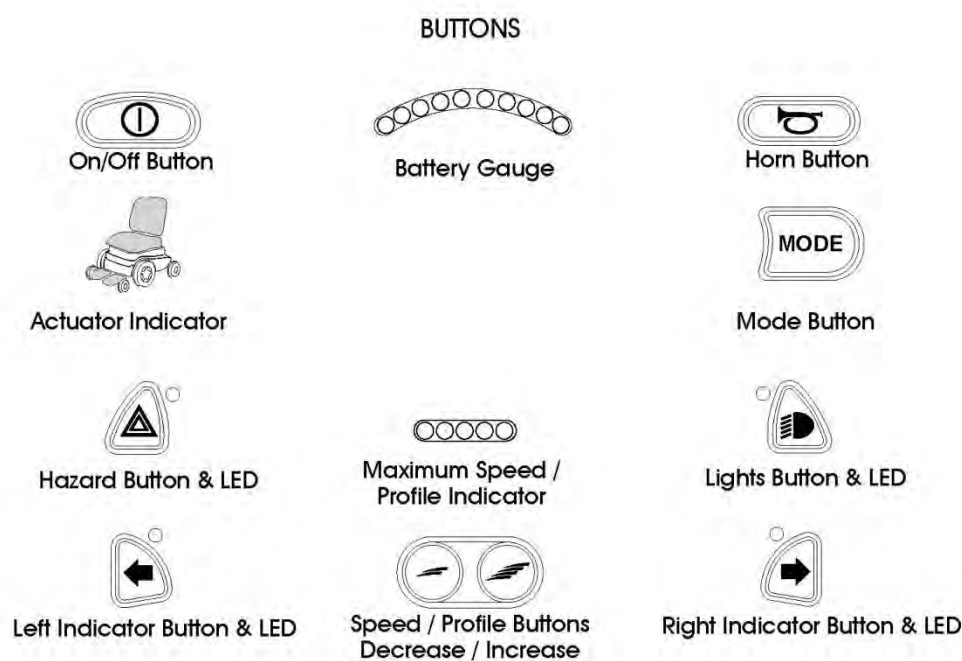
## 2 CONTROLS – JSM-LED AND JSM-LED-L

There are common controls between the R-net and R-net LED control systems that operate as previously described in Chapter 1. Where a control has been moved this will be noted, however where a control has changed, a description of its new functionality and use will be given.

All information regarding handling advice, cleaning requirements and overall control described in Chapter 1 should be followed.



## 2.1 BUTTONS



### 2.1.1 BATTERY GAUGE

The battery gauge shows you that the wheelchair is switched on. It also indicates the operating status of the wheelchair. Details are given in section 3.

If the battery gauge shows red, yellow and green, the batteries are charged. (LEDs 1 – 10)

If the battery gauge shows just red and yellow, then you should charge the batteries as soon as you can. (LEDs 1 – 7)

If the battery gauge shows just red, either steady or flashing slowly, then you should charge the batteries immediately. (LEDs 1 – 3)

#### **WARNING:**

**Do not operate the control system if the battery is nearly discharged. Failure to comply with this condition may leave the user stranded in an unsafe position, such as in the middle of a road. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

### 2.1.2 MAXIMUM SPEED / PROFILE INDICATOR

This is a gauge which shows the maximum speed setting for the wheelchair or, if the control system is programmed for drive profile operation, the selected drive profile.

This gauge also indicates if the speed of the wheelchair is being limited or if the control system is locked, refer to section 3.



### 2.1.2.1 MAXIMUM SPEED INDICATOR

This is a gauge that shows the maximum speed setting of the wheelchair. There are five speed settings – step 1 is the lowest speed and step 5 is the highest speed. For details of how to change the maximum speed setting, see sections 2.1.3 and 2.1.4.

### 2.1.2.2 PROFILE INDICATOR

This is an indicator that shows the selected drive profile. There may be up to 5 drive profiles available, this depends on the programming of the control system. For details of how to select drive profiles, see sections 2.1.3 and 2.1.4.

#### NOTE:

**A Control System utilizing an LED JSM should only be programmed with a maximum of 5 Profiles enabled.**

### 2.1.3 SPEED / PROFILE DECREASE BUTTON

This button decreases the maximum speed setting or, if the control system is programmed for drive profile operation, selects a lower drive profile.

It is possible to program the control system so this button has no effect while the wheelchair is being driven.

Refer to Chapter 3 - Programming for details.

### 2.1.4 SPEED / PROFILE INCREASE BUTTON

This button increases the maximum speed setting or, if the control system is programmed for drive profile operation, selects a higher drive profile.

It is possible to program the control system so this button has no effect while the wheelchair is being driven.

Refer to Chapter 3 - Programming for details.

### 2.1.5 MODE BUTTON

The Mode button allows the user to navigate through the available operating Modes for the control system. The available modes are dependent on programming and the range of auxiliary output devices connected to the control system.

Refer to Chapter 3 - Programming for details.

#### NOTE:

**When in any Mode other than Drive and Seating the Speed and Actuator LEDs are all extinguished.**

## 2.2 ACTUATOR INDICATOR

This LED set displays which Actuator channel is currently being controlled when the Control System is in Actuator Mode. The actuators can be programmed to work in multiple ways, refer to Chapter 3 Programming for details.

Actuator selection and operation is achieved using the Joystick.

Motions to the Left or Right select different actuator channels.

Motions Forward and Backwards move the actuator(s) selected.



### 3 CONTROL SYSTEM STATUS INDICATION

The battery gauge and maximum speed /profile indicator show the status of the control system.

A number of supposedly defective control systems returned to us are subsequently found to operate correctly. This indicates that many reported faults are due to wheelchair problems rather than the control system.

#### 3.1 BATTERY GAUGE IS STEADY

This indicates that all is well.

#### 3.2 BATTERY GAUGE FLASHES SLOWLY

The control system is functioning correctly, but you should charge the battery as soon as possible.

#### 3.3 BATTERY GAUGE STEPS UP

The wheelchair batteries are being charged. You will not be able to drive the wheelchair until the charger is disconnected and you have switched the control system off and on again.

#### 3.4 BATTERY GAUGE FLASHES RAPIDLY (EVEN WITH THE JOYSTICK RELEASED)

The control system safety circuits have operated and the control system has been prevented from moving the wheelchair.

This indicates a system trip, i.e. the R-net has detected a problem somewhere in the wheelchair's electrical system. Please follow this procedure:

- Switch off the control system.
- Make sure that all connectors on the wheelchair and the control system are mated securely.
- Check the condition of the battery.
- If you can't find the problem, try using the self-help guide given in section 3.7.
- Switch on the control system again and try to drive the wheelchair. If the safety circuits operate again, switch off and do not try to use the wheelchair.

Contact your service agent.

#### 3.5 SPEED INDICATOR RIPPLES OUTWARDS

In this instance the LEDs make a ripple motion starting with the middle LED and then stepping outwards on both sides. The Control System has detected that a new module has been added and is reconfiguring.

#### 3.6 SPEED INDICATOR LEDS 2 & 4 FLASH

**Speed 2 + 4** When the control system requires a reboot; for example, after a module re-configuration, the second and fourth speed indicator LEDs will flash.
















### 3.7 SELF-HELP GUIDE


If a system trip occurs, you can find out what has happened by counting the number of LEDs on the battery gauge that are flashing.

Below is a list of self-help actions. Try to use this list before you contact your service agent. Go to the number in the list which matches the number of flashing LEDs and follow the instructions.

If the problem persists after you have made the checks described below contact your service agent.

<b>1 LED</b> 	<b>The battery needs charging or there is a bad connection to the battery. Check the connections to the battery. If the connections are good, try charging the battery.</b>
<b>2 LED</b> 	<b>The left hand motor* has a bad connection. Check the connections to the left hand motor.</b>
<b>3 LED</b> 	<b>The left hand motor* has a short circuit to a battery connection. Contact your service agent.</b>
<b>4 LED</b> 	<b>The right hand motor* has a bad connection. Check the connections to the right hand motor.</b>
<b>5 LED</b> 	<b>The right hand motor* has a short circuit to a battery connection. Contact your service agent.</b>
<b>6 LED</b> 	<b>The wheelchair is being prevented from driving by an external signal. The exact cause will depend on the type of wheelchair you have.</b>
<b>7 LED</b> 	<b>A joystick fault is indicated. Make sure that the joystick is in the center position before switching on the control system.</b>
<b>8 LED</b> 	<b>A possible control system fault is indicated. Make sure that all connections are secure.</b>
<b>9 LED</b> 	<b>The parking brakes have a bad connection. Check the parking brake and motor connections. Make sure the control system connections are secure.</b>
<b>10 LED</b> 	<b>An excessive voltage has been applied to the control system. This is usually caused by a poor battery connection. Check the battery connections.</b>
<b>7 LED+ S</b> 	<b>A communication fault is indicated. Make sure that the joystick cable is securely connected and not damaged.</b>



<b>Actuator Flash</b> 	<b>An Actuator trip is indicated. If more than one actuator is fitted, check which actuator is not working correctly. Check the actuator wiring.</b>
--	--

\* If the programmable parameter, Motor Swap has been enabled, then left and right hand references in this table will need transposing.

### 3.8 SLOW OR SLUGGISH MOVEMENT

If the wheelchair does not travel at full speed or does not respond quickly enough, and the battery condition is good, check the maximum speed setting. If adjusting the speed setting does not remedy the problem then there may be a non-hazardous fault.

Contact your service agent.

### 3.9 MAXIMUM SPEED / PROFILE INDICATOR IS STEADY

The display will vary slightly depending on whether the control system is programmed to operate with drive profiles. For more information on drive profiles, refer to Chapter 3.

#### 3.10.1 SPEED INDICATION

The number of LEDs illuminated shows the maximum speed setting. For example, if the setting is speed level 4, then the four left hand LEDs will be illuminated.

#### 3.10.2 PROFILE INDICATION

The LED illuminated shows the selected drive profile. For example, if drive profile 4 is selected, then the fourth LEDs from the left will be illuminated.

### 3.11 MAXIMUM SPEED / PROFILE INDICATOR RIPPLES UP AND DOWN

This indicates the control system is locked, refer to Chapter 1 section 5.4 for details of how to unlock the control system.

### 3.12 MAXIMUM SPEED / PROFILE INDICATOR FLASHES

This indicates the speed of the wheelchair is being limited for safety reasons. The exact reason will depend on the type of wheelchair, however, the most common cause is that the seat is in the elevated position.

## 4 GETTING READY TO DRIVE

- Operate the On/Off switch. The battery gauge will blink then remain on after a few seconds.
- Check that the maximum speed control is set to a level that suits you.

### WARNING:

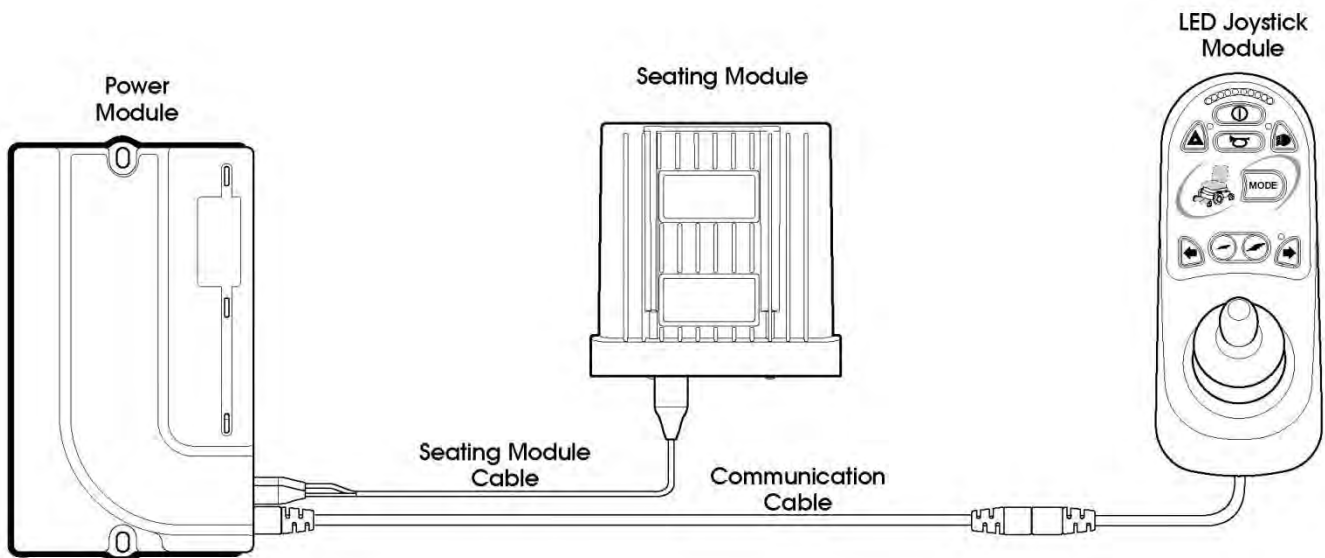
If you push the joystick before or just after you switch the control system on, the battery gauge will ripple up and down. You must release and center the joystick to resume normal operation. If you do not release the joystick within five seconds the wheelchair will not be able to move, even if you release the joystick and push it again. The battery gauge will flash 7 LEDs at this time. You can reset this condition by switching the control system off and on again. Refer to section 3.

If the battery gauge flashes rapidly, then the R-net has detected a problem somewhere in the wheelchair's electrical system. Refer to section 3 for details.

## 5 MOUNTING AND INSTALLATION

The modules that make up the LED range should be mounted as per the instructions in Chapter 2. Although the overall dimensions are different, in the case of the power module and the joystick module, the mounting hole size and positioning is the same.

Connecting the modules together is possible using the standard R-net Communication Cables, except in the case of the Seating Module that utilizes a specific cable that is supplied with the module.



### NOTE:

The Seating Module is connected to the EL Power Module using the Seating Module Cable, which connects to the Inhibit 2 and Actuator Channel 1 connections on the Power Module.





## 6 POWER MODULE & SM WIRING

### 6.1 GENERAL

Study the data sheets for the EL Power Module and the Seating Module to identify:

- The output current, ratings and restrictions.
- The connector pin assignments.

Recommendations for the cross-sectional area, ratings and materials for wiring are given in the table in Chapter 2. These depend on the application. You are responsible for establishing the suitability of the particular wiring arrangement used on the wheelchair. Curtiss-Wright can make general recommendations for wiring to R-net control systems, but Curtiss-Wright accepts no responsibility for the wiring arrangement used.

Make sure that the connectors you use are reliable under all operating conditions and correctly wired with no short circuits. Do not use unsuitable components - it may result in poor wheelchair reliability.

#### **WARNING:**

**The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair, for both normal use and stalled conditions. Curtiss-Wright can make general recommendations for wiring for R-net control systems, but Curtiss-Wright accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used.**

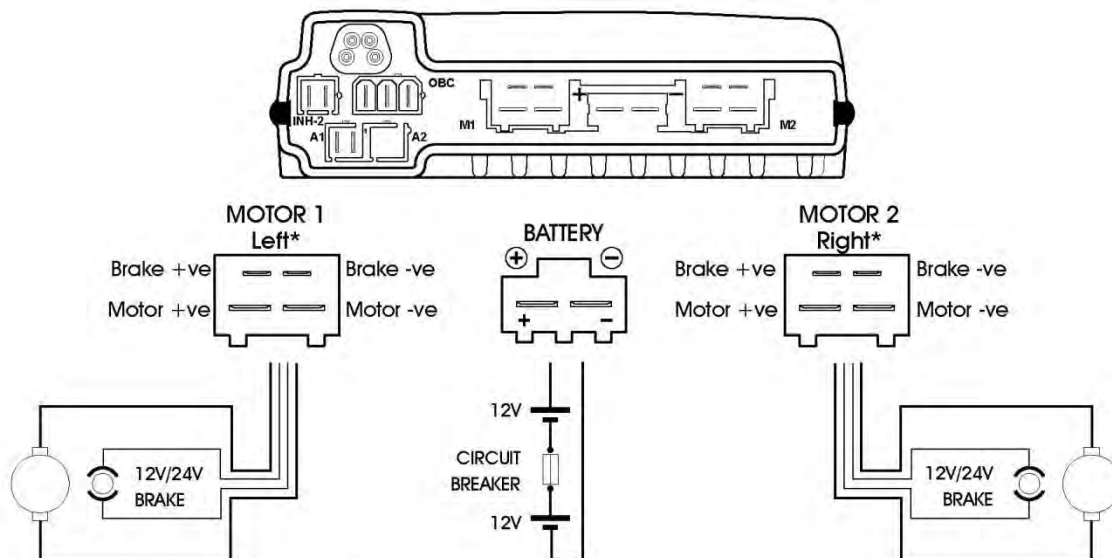
**The chair manufacturer is responsible for ensuring that only the mating connectors specified by Curtiss-Wright on the control systems' specific data sheet are used to connect to the control system. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

**The chair manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the chair wiring system and that the workmanship associated with the wiring system is of a good enough quality. Failure to meet this condition could result in intermittent operation, sudden stopping or veering, or even create a burn or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

The information pertaining to connectors, crimps and crimp tool part numbers can be found in Chapter 2.

### 6.1.1 POWER MODULE WIRING

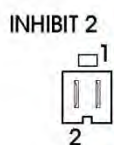
The following diagram gives details of the LED Power Module connections



\* Assumes no Motor Swap programming has been undertaken

Joystick Movement	M1		M 2		Actual Movement	
	Motor +ve	Motor -ve	Motor +ve	Motor -ve		
Forward	+ve	-ve	+ve	-ve	Forward	**
Backward	-ve	+ve	-ve	+ve	Backward	**

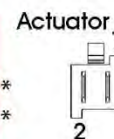
\*\* Assumes no Joystick Orientation, Invert M1 Direction or Invert M2 Direction programming has been undertaken



INH-2	Function
1	0V
2	Inhibit 2

Joystick Movement	Pin 1	Pin 2	Actuator Movement	
Forward	-ve	+ve	Channel Up	*
Backward	+ve	-ve	Channel Down	*

\* Assumes no Joystick Orientation programming has been undertaken



ON-BOARD CHARGER

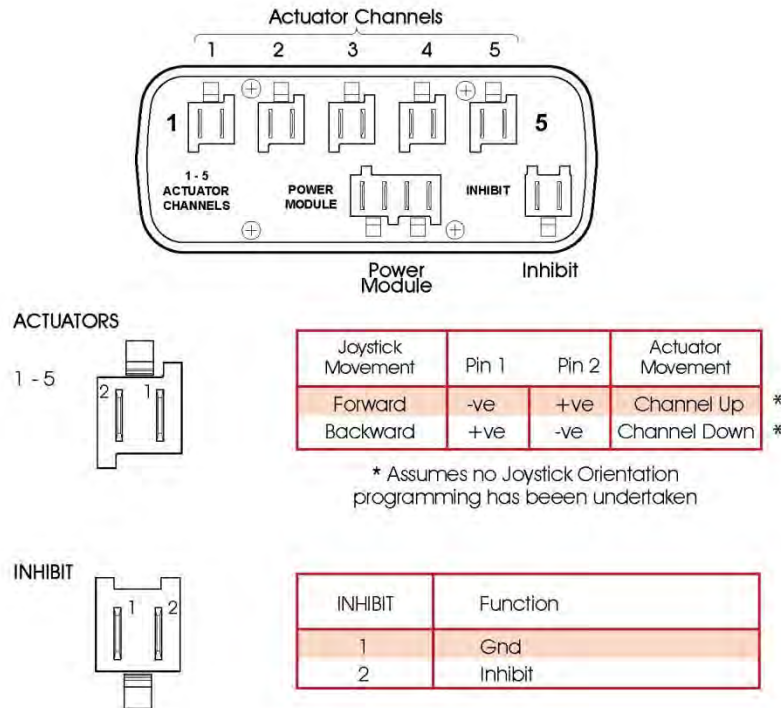


OBC	Function
1	Battery +ve
2	Inhibit 3
3	0V

The Power Module is shipped with rubber bungs inserted into some of the connectors. The A2 connector is blank and covered with a rubber bung. This should not be removed. Only remove the rubber bung from the required connectors.

## 6.1.2 SEATING MODULE WIRING

The following diagram gives details of the Seating Module connections.



## 6.1.3 CRIMPING

Refer to Chapter 2- Installation.

## 6.2 WIRE GAUGE AND TYPES

Refer to Chapter 2- Installation.

## 6.3 BATTERY AND MOTOR CONNECTIONS

Refer to Chapter 2- Installation.

## 6.4 EL PM TO SEATING MODULE CONNECTIONS

Use only a Curtiss-Wright supplied Seating Module Cable to connect between the EL PM and the Seating Module. The 4-way connector on this cable carries Actuator and Inhibit 2 connections, while the two 2-way connectors on the other end should be connected to the EL PM's Actuator and Inhibit 2 connections.

### NOTE:

If it is required to connect a switch directly to the Inhibit 2 connector on the EL PM, then the 2-way connector for Inhibit 2 on the Seating Module Cable should not be connected.



## 6.5 INHIBIT CONNECTIONS

As with standard PMs, the EL PM90 contains the Inhibit 2 and 3 connections. However, if the EL PM90 is used in conjunction with a Seating Module, then Inhibit 2 can be routed through to that module via the Seating Module Cable.

The Inhibit connections can be used to limit speed, inhibit drive and/or inhibit actuator channels. Refer to Chapter 3 – Programming for full details.

## 6.6 ACTUATOR CONNECTIONS

The EL PM90 has one actuator channel, which can be used in single actuator applications. However, the connection of a Seating Module consumes this channel, but effectively splits it into a maximum of 5. All actuator channels have a maximum rating of 12A.

### NOTE:

**The Seating Module does not support automatic end-stop detection. It is therefore recommended that actuators with series end-stop switches are used.**

## 7 PROGRAMMING

This section describes the programming functions that are associated with the Seating Module.

### NOTE:

**For any of the following programming to be effective, the parameter Seating Module Enabled must be set to Yes.**

### ACTUATOR AXES EXPLAINED

An actuator axis means a particular function of seat control. An axis may involve just one actuator motor, for example, a simple seat lift; or an axis may involve multiple motors, for example, adjustment of both footrests simultaneously or an anti-shear recline system. There are 5 actuator motor channels on the SM and a maximum of 12 axes are available. Unlike the ISM, the SM's 12 axes are pre-defined in terms of which channels are driven. This is shown in the table below.

Channels	Axis											
	1	2	3	4	5	6	7	8	9	10	11	12
1	x						x			x	x	x
2		x					x	x			x	x
3			x					x	x			x
4				x		x			x	x	x	x
5					x	x				x	x	x

For example: when Axis 1 is selected, then Channel 1 will be driven; and when Axis 6 is selected, then both Channels 4 and 5 will be driven.

For an axis to be available to the user, it must be enabled. The relevant programmable parameter is Axis Enabled.

The R-net SM can support up to 12 actuator axes with a maximum current of 12A across any combination of actuator channels.

The user display for a particular axis is programmable. The relevant parameter is Axis Display.



## 7.1 SEATING MODULE ENABLED

This parameter sets whether a Power Module is compatible with an ISM or with a Seating Module.

The parameter options are Yes or No.

If set to Yes, the Power Module will be compatible with a Seating Module. This setting should also be used if it is intended to use an EL PM90 to drive a single actuator.

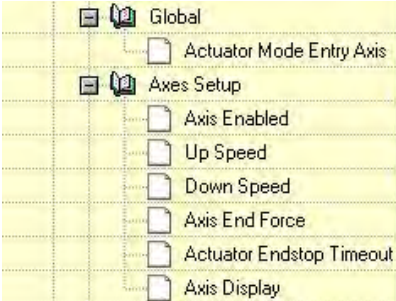
If set to No, the Power Module will be compatible with an ISM.

## SEATING MODULE – GLOBAL

### 7.2 ACTUATOR MODE ENTRY AXIS - (ACT. ENTRY AXIS)

This sets the actuator axis that is selected when Seating Mode is entered.

The programmable options are in the form of a drop-down menu, as shown in the following diagram.



	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Axis 1	No	No	No	No	No	No	No
Axis 2	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Axis 3	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Axis 4	12	12	12	12	12	12	12
Axis 5	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms
Axis 6	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Axis 7	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Axis 8	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Axis 9	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Axis 10	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Simply select the required axis. If Last used is selected, this means the axis that was selected on the last occasion Seating Mode was used will be the selected axis when Seating Mode is re-entered.

## SEATING MODULE - AXES SETUP

### 7.3 AXIS ENABLED

This parameter sets if an axis is available to a user.

The parameter options are Yes or No.

If set to Yes, the axis is available.

If set to No, the axis is not available.

### 7.4 UP SPEED - (UPSPD)

This sets the speed of the SM channel(s) in a given axis in the Up direction.

Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward.

Programmable range is 25% to 100% in steps of 1%.

## 7.5 DOWN SPEED - (DNSPD)

This sets the speed of the SM channel(s) in a given axis in the Down direction.

Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse.

Programmable range is 25% to 100% in steps of 1%.

### 7.5.1 AXIS END FORCE

This parameter sets the maximum force for a particular actuator Axis. The parameter is programmable between 2-12 in steps of 1. The PG default value is 12. The value of Endforce roughly equates to Amps.

## 7.7 ACTUATOR CURRENT LIMIT TIMEOUT

This parameter sets the time after which Endforce will not be applied to the actuator. It is programmable between 0 (OFF) and 5000ms in steps of 10ms. The PG default value is 0 (OFF).

## 7.6 AXIS DISPLAY

This parameter sets which Actuator Indicator LED(s) on a JSM-LED are illuminated when a particular axis is selected.

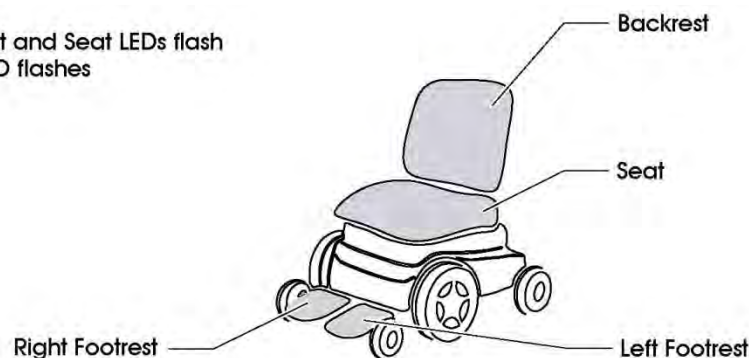
If the Seating Module is being used in conjunction with an LCD based Module, then this parameter will set which elements in the wheelchair symbol on the display are illuminated.

The programmable options are in the form of a drop down menu, as shown in the following diagram.

Down Speed	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Axis Display	Backrest	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Axis Inhibits	Tilt Arrow	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Up: Assign	Seat	Off	Off	Off	Off	Off	Off	Off
Up: Inhibit in Bands	Right Footrest	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Down: Assign	Left Footrest	Off	Off	Off	Off	Off	Off	Off
Down: Inhibit in Bands	Lift Arrow	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

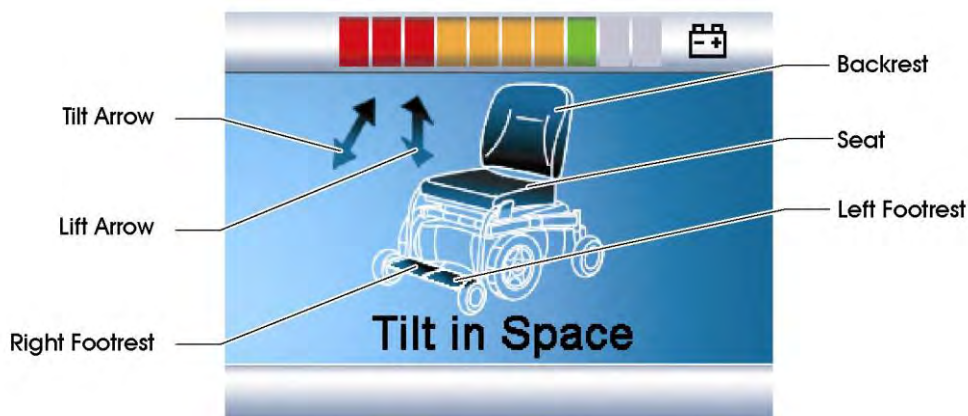
In the case of the JSM-LED, the programmable options relate to the wheelchair symbol as below.

Tilt Arrow = Backrest and Seat LEDs flash  
Lift Arrow = Seat LED flashes



In the case of an LCD based Joystick Module, the programmable options relate to the wheelchair symbol as below.





### Example

To configure the R-net to control actuator motors connected to the left and right footrests simultaneously, the previously described parameters should be set as follows.

Axis 6 Enabled – Yes

Axis 6 Display – 4,5 (Left Footrest, Right Footrest)

Actuator Mode Entry Axis	Last used	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Axis Setup									
Axis Enabled	No	No	No	No	No	No	Yes	No	No
Up Speed	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Down Speed	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Axis Display	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ 45 ]	[ ]	[ ]
Axis Inhibits									
Up Assign	Off	Off	Off	Off	Off	Off	Off	Off	Off



In this instance, selecting Axis 6 on the Joystick Module will illuminate both Footrest LEDs, and movement of the joystick either forward or backwards will activate the actuator motors connected to channels 4 and 5.

## SEATING MODULE - AXES INHIBITS

### 7.7 AXIS X – UP ASSIGN (X = 1 TO 12)

Each actuator axis has a software inhibit for its up direction. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward. The inhibit can be initiated by any actual hardware inhibit in the system.

The parameter, Assign, links the software inhibit to an actual hardware inhibit. For example, if Assign: is set to 2, then the axis can be inhibited by Inhibit Input 2.



The programmable options are Off and 2 to 33.

If set to Off, then the relevant Axis x Up Inhibit can never be active.

If set to a numeric value, then the relevant Axis x Up Inhibit will be under the control of the Inhibit Input that corresponds to that number.

## 7.8 AXIS X – UP INHIBIT IN BANDS (X = 1 TO 6)

This sets the condition of the input (assigned to Axis x Up Inhibit) that will result in an inhibit of the actuator drive in the up direction. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward. The inhibit can be set to occur in any combination of bands. See *Inhibits Explained* in Chapter 3 Programming for more details on bands.

The programmable options are Band 0, Band 1, Band 2 and Band 3.

If the parameter is selected, then a drop down menu as below will appear and the bands required to invoke the inhibit should be selected. For example, if the inhibit is required for Band 3 only, then that option should be selected, as shown.



When the drop down menu is closed, a 3 will be shown in the cell.

## 7.9 AXIS X – DOWN ASSIGN (X = 1 TO 12)

Each actuator axis has a software inhibit for its down direction. Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse. The inhibit can be initiated by any actual hardware inhibit in the system.

The parameter, Assign, links the software inhibit to an actual hardware inhibit. For example, if Assign: is set to 2, then the axis can be inhibited by Inhibit Input 2.

The programmable options are Off and 2 to 33.

If set to Off, then the relevant Axis x Down Inhibit can never be active.

If set to a numeric value, then the relevant Axis x Down Inhibit will be under the control of the Inhibit Input that corresponds to that number.

## 7.10 AXIS X – DOWN: INHIBIT IN BANDS (X = 1 TO 6)

This sets the condition of the input (assigned to Axis x Down Inhibit) that will result in an inhibit of the actuator drive in the down direction. Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced backwards. The inhibit can be set to occur in any combination of bands. See *Inhibits Explained* in Chapter 3 Programming for more details on bands.

The programmable options are Band 0, Band 1, Band 2 and Band 3.

If the parameter is selected, then a drop down menu as below will appear and the bands required to invoke the inhibit should be selected. For example, if the inhibit is required for Band 3 only, then that option should be selected, as shown.



When the drop down menu is closed, a 3 will be shown in the cell.



## CHAPTER 5 – ENCODER MODULE

### 1 INTRODUCTION

The Encoder Module is used on wheelchair with encoders fitted to the motors.

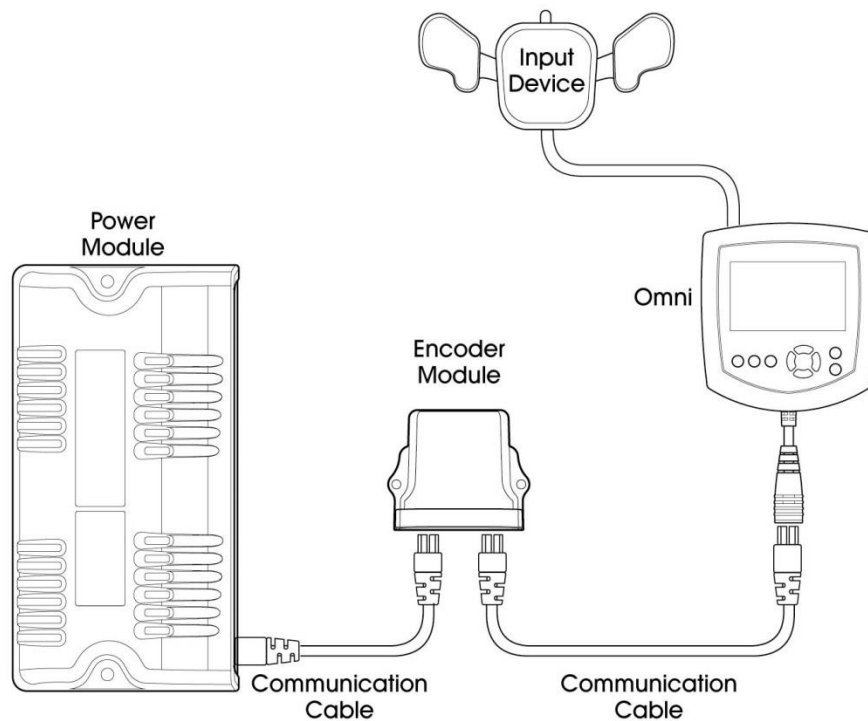
An encoder is a device that monitors the speed and direction of the wheelchair motors. The encoder converts information such as position and direction of rotation of the motor into a digital signal which can be used by the R-net system to accurately control the speed and direction of the wheelchair.

**NOTE:**

**The Curtiss-Wright Encoder Module should only be used with 24V Encoders, with a current rating of 75mA per channel.**

### 2 INSTALLATION

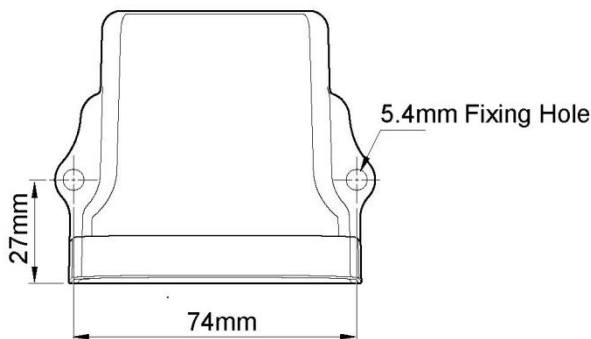
The Encoder Module can connect into the R-net serial bus at any convenient point.



## 3 MOUNTING

### 3.1 ORIENTATION

The Encoder Module should be mounted so that water cannot enter and remain in the connector recesses. The recommended mounting orientation is such that the Module is lying flat. The function of the Encoder Module is not sensitive to mounting orientation. The electronics compartment of the controller has an IPX4 dust and water rating.



### 3.2 POSITION

The Encoder Module must be mounted in a position where it is not exposed to levels of water, dust, shock or vibration above those expected on a mobility application. The Encoder Module has been tested in accordance with ISO7176/14 with respect to these conditions. Contact Curtiss-Wright if you need further advice.

### 3.3 CONNECTIONS

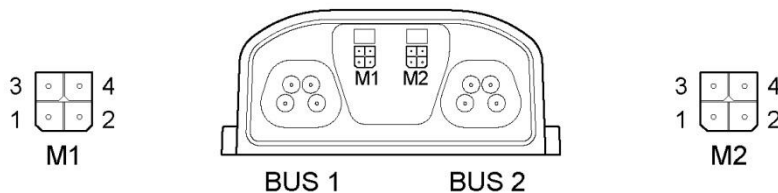
There are two 4-way connectors, one for each encoder. The pin-out for these connectors is as below.

Encoder Module connector kit is D51261 or the parts can be sourced directly from Molex

Housing- 43025-0400

Crimp- 43030-0007

M2 Pin	Function
Supply +24V	1
Encoder Ground	2
Encoder A	3
Encoder B	4



M1 and M2 pin-out are viewing rear of mating connector.

For Encoder A and Encoder B signal details, refer to the sections Invert M1 and Invert M2.



## 4 PROGRAMMING

Within the Encoders branch of the PC Programmer, there are the following parameters.

Encoders	
Encoder Module Fitted	No
Encoder Error Speed Limit	50 %
Invert M1	No
Invert M2	No
Encoder Resolution	32 pprev
Motor Rated Speed	1000 rpm

Additionally, to ensure system safety should an encoder become defective or disconnected, it is also necessary to set the standard R-net parameter, Compensation.

Each of the parameters are described below.

### 4.1 ENCODER MODULE FITTED

This sets whether the Power Module checks for the presence of an Encoder Module, which in turn checks for correctly functioning encoders.

The programmable options are Yes and No.

If set to Yes and functioning encoders are not connected, then an error condition will occur.

If set to No and functioning encoder are not connected, then conventional drive control will occur.

### 4.2 ENCODER ERROR SPEED LIMIT

This sets the maximum speed of the wheelchair should an encoder error be detected.

The programmable range is 0% to 100% in steps of 1%.

### 4.3 INVERT M1

This reverses the way the speed and direction signals are read from the encoder fitted to the motor that is connected to the Power Module's M1 connector.

The programmable options are Yes and No. The table below shows the effect of each option.

Motor Direction	Invert M1	Polarity of Encoder B on a rising edge of Encoder A
Forward	No	Low
Reverse	No	High
Forward	Yes	High
Reverse	Yes	Low



#### 4.4 INVERT M2

This reverses the way the speed and direction signals are read from the encoder fitted to the motor that is connected to the Power Module's M1 connector.

The programmable options are Yes and No. The table below shows the effect of each option.

Motor Direction	Invert M2	Polarity of Encoder B on a rising edge of Encoder A
Forward	No	Low
Reverse	No	High
Forward	Yes	High
Reverse	Yes	Low

#### 4.5 ENCODER RESOLUTION

This must be set to the number of pulses per revolution that the encoders output.

The programmable range is 1pprev to 128pprev in steps of 1pprev.

#### 4.6 MOTOR RATED SPEED

This should be set to the motor manufacturer's stated speed for the motor at 24V. The R-net's speed control loop will then give a full forward motor speed as expressed below, assuming the parameter, Forward Speed, is set to 100% and no speed limits are active.

Full forward motor speed =  $(21.6 / 24) \times \text{Motor Rated Speed}$

The programmable range is 150rpm to 9775rpm in steps of 1rpm

**NOTE:**

**If a slower full forward motor speed is required, then the parameter, Forward Speed, should be set accordingly.**

#### 4.7 COMPENSATION

Even though this parameter is not used for speed control, to ensure safety, particularly if an encoder becomes defective or disconnected, then it is still essential this value is set correctly.

The programmable range is 0mOhms to 500mOhms in steps of 5mOhms.

Curtiss-Wright recommend this value is initially set to 70% of the total resistance of the motor's armature, and all the connector and cables between the motor and the Power Module motor output. Motor manufacturers should be able to supply a figure the motor's armature resistance, and typical connector and cables may be around 40mOhm.

Example: The motor has a specified armature resistance of 100mOhms, and cables and connectors between the motor and the Power Module are estimated to be 40mOhm. This gives a total values of 140mOhm. The value of Compensation should therefore be set to 70% of 140mOhm = 100mOhm.

## CHAPTER 6 – ADVANCED STABILITY & TILT MODULE

### 1 INTRODUCTION

The R-net Advanced Stability Module (ASM) uses accelerometer technology to help maintain the turning stability of wheelchairs, in particular fast front wheel drive models. In the event that the wheelchair does approach an unstable situation the ASM will control the wheelchair turning speed whilst the joystick is deflected. It is recommended that for front wheel drive chairs both an ASM is fitted and the Enhanced Front Wheel Drive (eFWD) software algorithm is employed. Contact the Curtiss-Wright applications department for a detailed set up procedure for front wheel drive chairs. In addition, the ASM can also be used as a Tilt Module (TM)

– a typical application being to measure the angle of recline of a wheelchair's adjustable seat. To allow both an ASM and a TM to be used on the same wheelchair, there are two different part numbers

D51508.xx = ASM and TM – selected by programming

D51557.xx = TM only

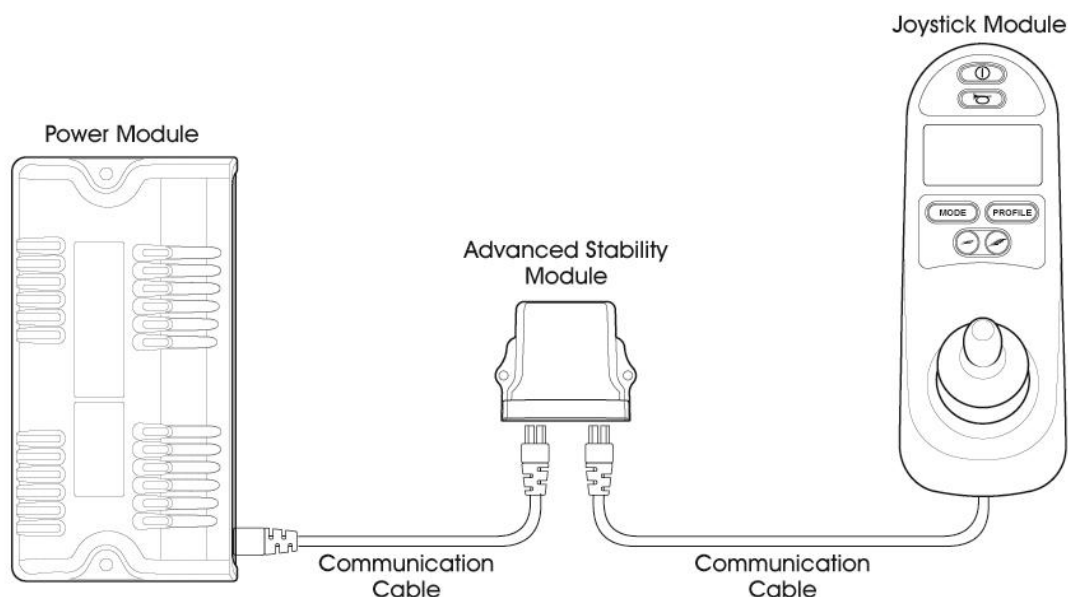
#### NOTE:

**D51508.01 = ASM only**

**It is not possible for two Modules of the same type to be connected into an R-net system. However, if two tilt related functions are required, then an ASM (programmed to Tilt) and a TM can be used.**

### 2 INSTALLATION

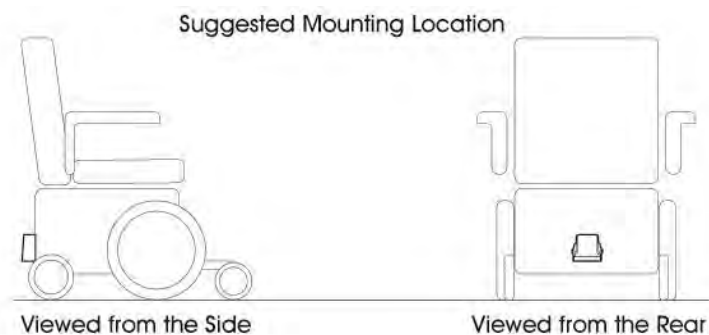
The ASM can connect into the R-net serial bus at any convenient point.



## 2.1 ASM MOUNTING

The R-net ASM must be mounted:

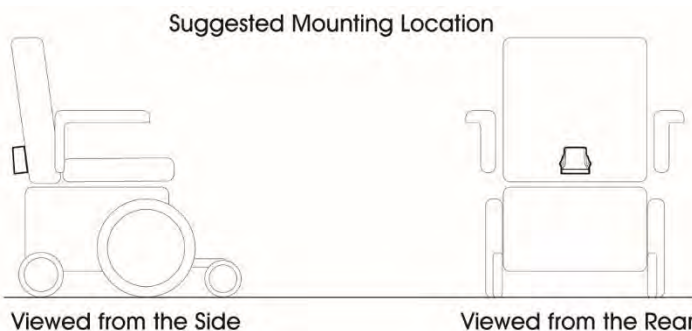
1. In a position where impact is unlikely.
2. On a surface either perpendicular or parallel to the Ground. Note: small forward tilt offsets ( $<10^\circ$ ) can be corrected for using the programmable parameters, but transverse offsets cannot be corrected for.
3. In one of the eight supported orientations. Refer to see section 3.2.
4. Firmly to the chassis.
5. As near to the back of the wheelchair as possible to provide a good signal strength.
6. At a vertical height level with the center of the drive wheels. To help prevent large transverse accelerations when going over bumpy ground.



## 2.2 TM MOUNTING

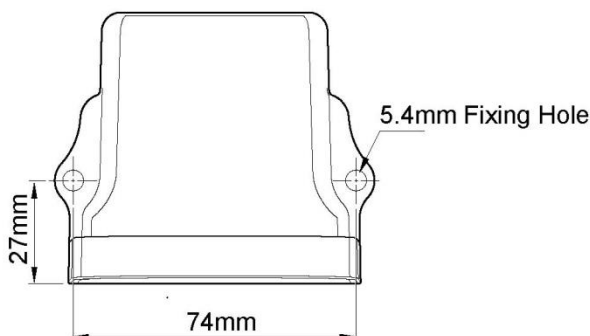
The R-net TM must be mounted:

1. In a position where impact is unlikely.
2. To a surface of the item from which the angle is to be measured.
3. In one of the eight supported orientations. Refer to see section 3.9.



## 2.2 ORIENTATION

The ASM/TM should be mounted so that water cannot enter and remain in the connector recesses. The recommended mounting orientation is such that the Module is standing upright with the connectors pointing down. The function of the ASM/TM is sensitive to mounting orientation, therefore once mounted refer to the Programming section of the Chapter. The module has an IPX4 dust and water rating.

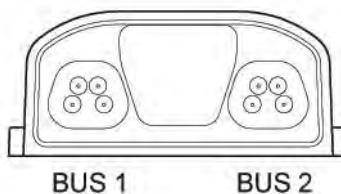


## 2.3 POSITION

The ASM/TM must be mounted in a position where it is not exposed to levels of water, dust, shock or vibration above those expected on a mobility application. The ASM/ TM has been tested in accordance with ISO7176/14 with respect to these conditions. Contact Curtiss-Wright if you need further advice.

## 2.4 CONNECTIONS

There are two ReBus connectors within the ASM/ TM used for connection to the R-net system.



# 3 PROGRAMMING

The ASM and TM parameters are held within their own programming group and the main Inhibits Group.

### Stability/

#### Advanced Stability Module (ASM)

##### Global

Function	Sets what function the Module will perform
Orientation	Sets the expected mounting orientation for the module on the chair
Null Calibration	Sets a tilt angle offset to allow for the modules mounting position
Accelerometer	
Accelerometer Module Fitted	Sets whether the Power Module checks for the presence of an ASM
Accelerometer Error Speed Limit	Sets the maximum speed of the wheelchair should an ASM error be detected
Maximum Acceleration Threshold	Sets the acceleration above which the forward speed will start to be scaled
Minimum Acceleration Threshold	Sets the acceleration at which the scaled forward speed is applied
Minimum Forward Speed Scaler	Sets the scaling ratio applied to the forward speed of the wheelchair when the value of Maximum Acceleration Threshold is reached
Anti-Spin	Sets the effectiveness of the ASM in preventing spin-out when there is a loss of traction

##### TILT

Forward Tilt Input	Sets if the Forward Tilt Input is interrogated
--------------------	--

#### Tilt Module

Orientation	Sets the expected mounting orientation for the module on the chair
Forward Tilt Input	Sets if the Forward Tilt Input is interrogated

**Inhibits/****Global**

Disable Inhibit 8 in Drive

*Sets whether Inhibit 8 input is interrogated constantly or just at entry into Drive Mode*

Disable Inhibit 9 in Drive

*Sets whether Inhibit 9 input is interrogated constantly or just at entry into Drive Mode***Inputs**

Lower Level Threshold

*Sets the threshold between Band 0 and Band 1 for Inhibit Input 8 or 9*

Middle Level Threshold

*Sets the threshold between Band 1 and Band 2 for Inhibit Input 8 or 9*

Upper Level Threshold

*Sets the threshold between Band 2 and Band 3 for Inhibit Input 8 or 9*

Debounce Time

*Sets a debounce time for the inhibit input.*

## STABILITY - ADVANCED STABILITY MODULE – GLOBAL

### 3.1 FUNCTION

This parameter sets the function of the ASM.

The programmable options are Accelerometer, Tilt and Both.

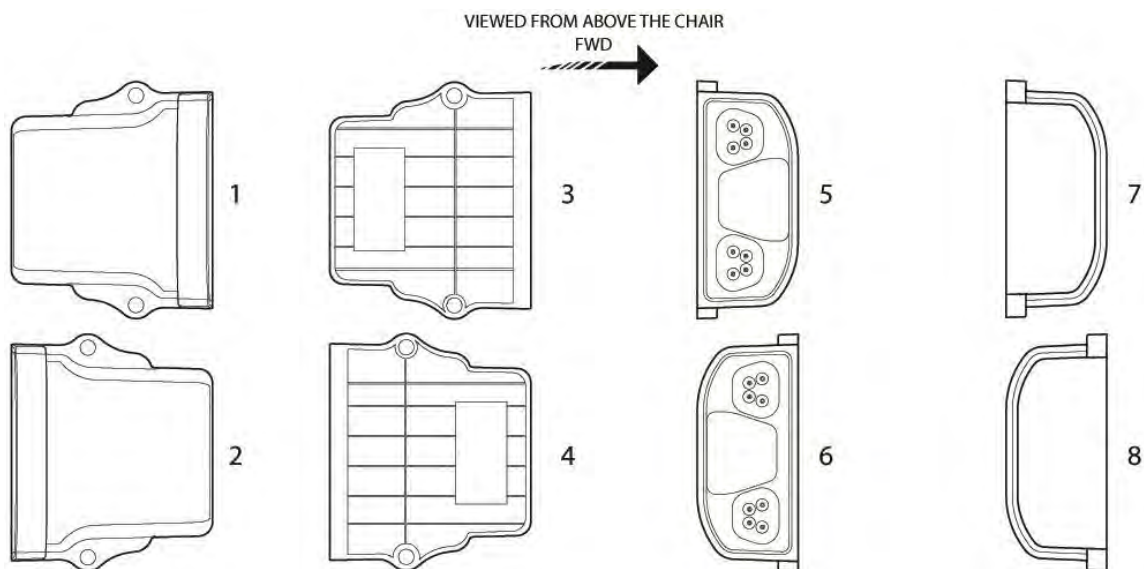
If set to Accelerometer the ASM will operate as a drive stability module.

If set to Tilt, the ASM will operate as a tilt module.

If set to Both, the ASM will operate as both a drive stability and a tilt module.

### 3.2 ORIENTATION

Orientation sets the expected mounting of the ASM with respect to the forward driving direction of the wheelchair. There are eight programmable options. If this parameter is not programmed to the correct setting an orientation error will be reported.



### 3.3 NULL CALIBRATION

The ASM can be programmed to remove a small forward/reverse tilt offset when the module is mounted on a surface which is not perpendicular or parallel to the ground (in the forward-reverse plane). The offset can be read in the ASM status window of the PC programmer. A minus reading in the status window can be offset by entering the opposite value for this parameter. E.g.





the status window reads  $-5^\circ$ , then null offset should be programmed to a value of  $5^\circ$ . The parameter can be programmed between  $-10^\circ$  to  $+10^\circ$  and should be factory set by the OEM as part the chair design. It is not possible to remove a transversetilt offset.

## STABILITY - ADVANCED STABILITY MODULE – ACCELEROMETER

### 3.4 ACCELEROMETER MODULE FITTED

This sets whether the Power Module checks for the presence of an ASM.

The programmable options are Yes and No.

If set to Yes and the ASM is not connected, then the wheelchair forward speed will be limited to the value set by Accelerometer Error Speed Limit.

If set to No and the ASM is not fitted then no speed limit will be present.

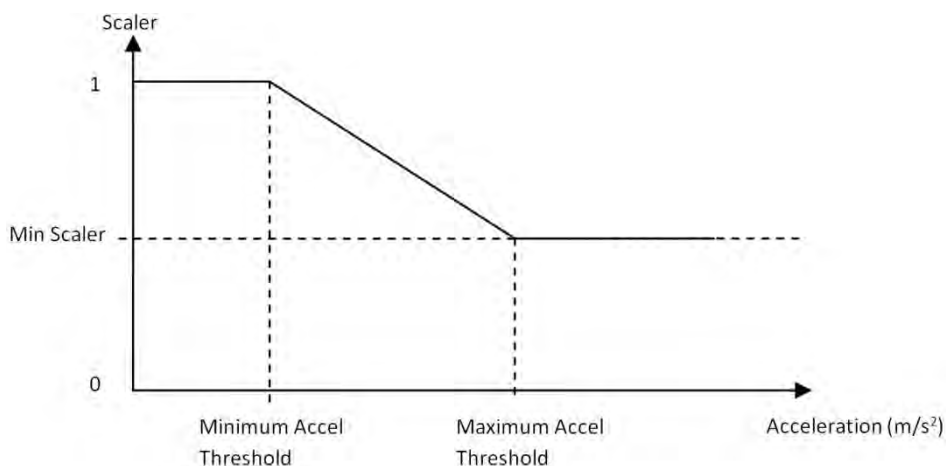
### 3.5 ACCELEROMETER ERROR SPEED LIMIT

This sets the maximum speed of the wheelchair should an ASM error be detected.

The programmable range is 0% to 100% in steps of 1%.

### 3.6 MAXIMUM ACCELERATION THRESHOLD, MINIMUM ACCELERATION THRESHOLD, FORWARD SPIN SCALAR

The effect of parameters Maximum Acceleration Threshold, Minimum Acceleration Threshold and Minimum Forward Speed Scaler is best shown in the diagram below.



These three parameters set a relationship between the acceleration of the wheelchair and its permitted forward speed in order to maintain stability. Note, in the diagram, the y-axis is scaled forward speed.

Minimum Acceleration Threshold:

Sets the acceleration above which the forward speed will start to be scaled (reduced).

This parameter is programmable between  $0.0\text{m/s}^2$  and  $10\text{m/s}^2$  in steps of  $0.1\text{m/s}^2$ .



#### Maximum Acceleration Threshold:

Sets the acceleration at which the scaled forward speed is applied.

This parameter is programmable between  $1.0 \text{ m/s}^2$  and  $10 \text{ m/s}^2$  in steps of  $0.1 \text{ m/s}^2$ .

#### Minimum Forward Speed Scaler:

Sets the scaling ratio applied to the forward speed of the wheelchair when the value of Maximum Acceleration Threshold is reached.

This parameter is programmable between 0% and 100%.

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### 3.7 ANTI-SPIN

Anti-Spin sets the effectiveness of the ASM in preventing spin-out when there is a loss of traction. The higher the value of Anti-Spin, the more effect the ASM is in preventing the wheelchair spinning out.

If the value is set too high then normal turning may be affected. I.e. the wheelchair may decelerate rapidly during a turn.

This parameter is programmable between 0 and 100% where 0 disables the function.

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## STABILITY - ADVANCED STABILITY MODULE – TILT

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### 3.8 FORWARD TILT INPUT

The R-net ASM measures the real angle of tilt using the forward Tilt Input. This information is transferred onto the R-net bus as standard inhibit messages, which can be interpreted by other modules to effect seat movement inhibits or drive speed limits.

The programmable options are None, Inhibit 8 and Inhibit 9.

If set to none, the Forward Tilt Input is ignored.

If set to Inhibit 8 or 9 the Forward Tilt Input is used as the input for the programmed inhibit. Refer to *ASM/TM Inhibits Explained* at the end of this section for more information

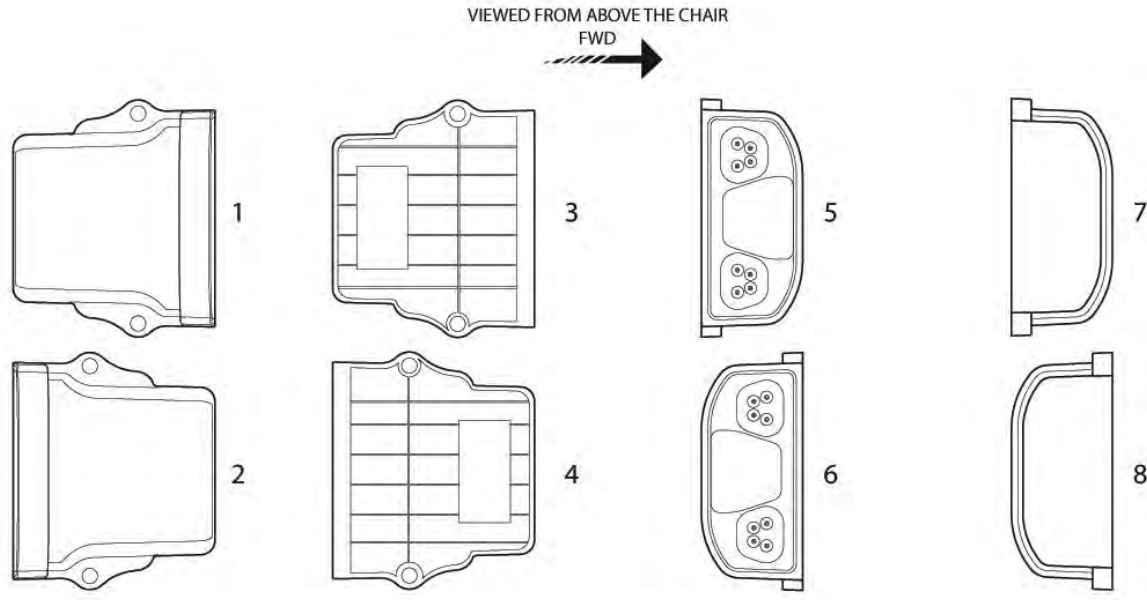
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## STABILITY - TILT MODULE

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### 3.9 ORIENTATION

Orientation sets the expected mounting of the TM with respect to the forward driving direction of the wheelchair. There are 8 programmable options. If this parameter is not programmed to the correct setting an orientation error will be reported.



### 3.10 FORWARD TILT INPUT

The R-net TM measures the real angle of tilt using the forward Tilt Input. This information is transferred onto the R-net bus as standard inhibit messages, which can be interpreted by other modules to effect seat movement inhibits or drive speed limits.

The programmable options are None, Inhibit 8 and Inhibit 9.

If set to none, the Forward Tilt Input is ignored.

If set to Inhibit 8 or 9 the Forward Tilt Input is used as the input for the programmed inhibit. Refer to *ASM/TM Inhibits Explained* at the end of this section for more information.

## INHIBITS – GLOBAL

### 13.1 DISABLE INHIBIT 8 IN DRIVE

This sets whether Inhibit 8 input is interrogated just at entry into Drive Mode or constantly during Drive Mode.

The programmable options are Yes and No.

If set to Yes, the input will only be interrogated at entry into Drive Mode. An example of when this function may be useful is if a tilt-sensor is used that could be inadvertently operated when driving over rough terrain. By employing this function, an inhibit will only be applied if Drive Mode is entered with the seat in a genuinely tilted position.

If set to No, the input will be interrogated constantly during Drive Mode, i.e. normal inhibit operation.

### 13.2 DISABLE INHIBIT 9 IN DRIVE

This sets whether the Inhibit 9 input is interrogated just at entry into Drive Mode or constantly during Drive Mode.

The programmable options are Yes and No.



If set to Yes, the input will only be interrogated at entry into Drive Mode. An example of when this function may be useful is if a tilt-sensor is used that could be inadvertently operated when driving over rough terrain. By employing this function, an inhibit will only be applied if Drive Mode is entered with the seat in a genuinely tilted position.

If set to No, the input will be interrogated constantly during Drive Mode, i.e. normal inhibit operation.

## INHIBITS - INPUT ASM/TILT

### 3.11 LOWER LEVEL THRESHOLD

This sets the level of the threshold between Band 0 and Band 1 for Inhibit 8 or 9 Input. See *ASM/TM Inhibits Explained* for more details on inhibits and Bands.

The programmable range is -90 degrees to +90 degrees in steps of 1 degree.

### 3.12 MIDDLE LEVEL THRESHOLD

This sets the level of the threshold between Band 1 and band 2 for Inhibit 8 or 9 Input. See *ASM/TM Inhibits Explained* for more details on inhibits and bands.

The programmable range is -90 degrees to +90 degrees in steps of 1 degree.

### 3.13 UPPER LEVEL THRESHOLD

This sets the level of the threshold between Band 2 and band 3 for Inhibit 8 or 9 Input. See *ASM/TM Inhibits Explained* for more details on inhibits and bands.

The programmable range is -90 degrees to +90 degrees in steps of 1 degree.

### 3.14 DEBOUNCE TIME

This sets a debounce time for the Inhibit input. Debounce is the amount of time the input must be stable before a new condition is registered. This is particularly useful if mercury switches are being employed and eliminates the effect of “splashing” across the contacts.

The programmable range is 0mS to 400mS in steps of 50mS.

## ASM/TM INHIBITS EXPLAINED

The ASM and TM have programmable software inhibits, Inhibit 8 and 9. Each of these inputs can recognize four different input conditions (or states). This means that four different events can originate from a single input. See the following Tilt Inhibit Example.

The state of an Inhibit input is defined as measurement of angle set by the Forward Tilt Input.

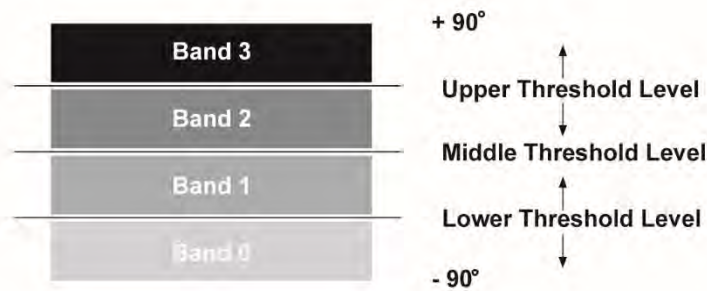
Dependent on the state of an input, it is in one of four bands. The size of these bands is programmable via the parameters Lower Level Threshold, Middle Level Threshold and Upper Level Threshold. These are shown in the following diagram.

Each of the Threshold Level parameters can be set between -90 degrees to +90 degrees in steps of 1 degree.

After the input bands have been defined, then each input can be linked to a speed limit or full drive inhibit via the parameters: Assign, Speed Limit in Band 0, Speed Limit in Band 1, Speed Limit in Band 2 and Speed Limit in Band 3.



Assign, Speed Limit in Bands 0, 1, 2 and 3 as Operation.



Each input can also be linked to an actuator function via the parameters: Assign, Channel x Up: Inhibit in Bands and Channel x Down: Inhibit in Bands.

### TILT EXAMPLE

**Application:** A wheelchair is fitted with a reclining seat. It is required to offer a programmable angle of recline to suit different users. A TM is fitted to the recline mechanism and the forward tilt input has been assigned to Inhibit 8 used by the TM.

In this example the TM is programmed to Orientation 8 and the Recline motor has been connected to Actuator Channel 1.

The Inhibit input must be assigned to a specific software Inhibit. As this is an Actuator Inhibit, the parameters Actuator Inhibits Channel 1 - Up: Assign & Down: Assign should be used.

The inputs are therefore assigned to Actuator Inhibits Channel 1 as follows:

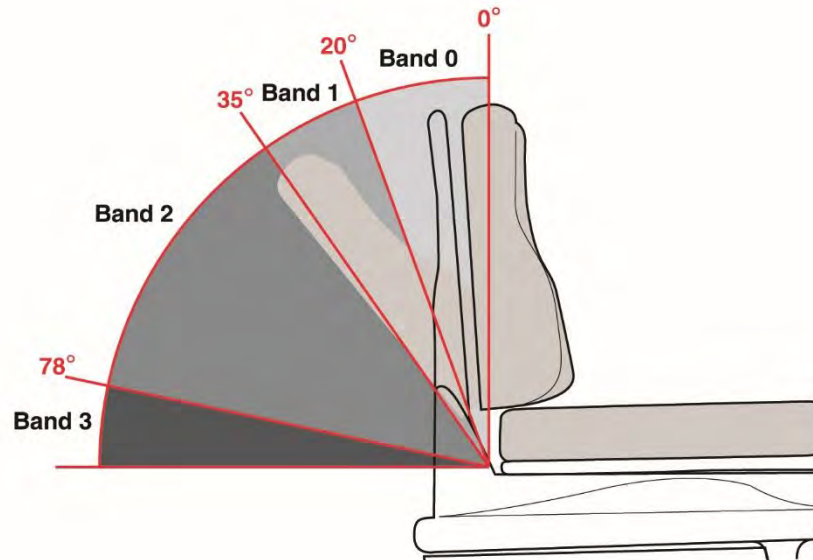
Down: Assign - Input 8

As these inputs are connected to the TM the threshold levels must be set in the parameter Inputs – ASM/TM.

The Inhibit 8 thresholds are set in degrees as follows

Inputs - ASM/TM	
<input type="checkbox"/> Lower Level Threshold Inh. 8	20 °
<input type="checkbox"/> Middle Level Threshold Inh. 8	35 °
<input type="checkbox"/> Upper Level Threshold Inh. 8	78 °
<input type="checkbox"/> Debounce Time Inh. 8	100 ms

This gives a band arrangement as follows



By programming the Actuator Channel 1 Down Inhibit parameters as below, it is possible to program the maximum angle of travel of the recline mechanism via Inhibit8.

<input type="checkbox"/> Down: Assign	8
<input type="checkbox"/> Down: Inhibit in Bands	[ 3]

This programming means that the Down movement will be inhibited when the Inhibit8 input is in Band 3, i.e. the recline angle is greater than 78°.

<input checked="" type="checkbox"/> Drive Inhibits:	A
<input type="checkbox"/> Assign	8
<input type="checkbox"/> Speed Limit in Band 0	100 %
<input type="checkbox"/> Speed Limit in Band 1	50 %
<input type="checkbox"/> Speed Limit in Band 2	25 %
<input type="checkbox"/> Speed Limit in Band 3	0 %

The inhibit8 messages can be used by other modules to evoke drivespeed limits. In this case a full drive lock out when tilted greater than 78° in band 3, a reduced speed in bands 2 and 1 when the seat is tilted between 77° and 20° and no speed restriction in band 0 when the angle is less than 19°.

## CHAPTER 7 – GYRO MODULE

### 1 INTRODUCTION

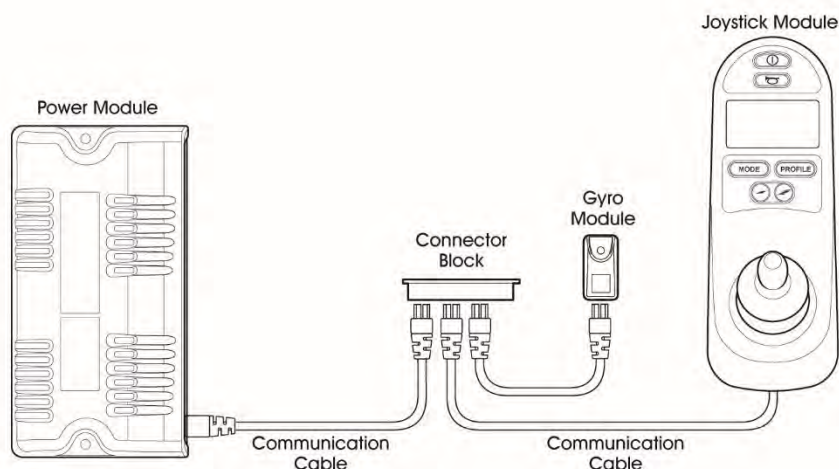
The Gyro Module works by combining input demand from a joystick or switch control with gyroscopic information about the direction that the wheelchair is tracking. When the system detects that the wheelchair is deviating from the intended course of direction it automatically corrects the path of travel.

#### **WARNING:**

**The Gyro cannot be used on moving vehicles, such as buses or trains. For this reason, there should always be at least one drive profile that does not have the Gyro control enabled so that the chair is always safe and stable to drive without Gyro. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

### 2 INSTALLATION

The Gyro Module can connect into the R-net serial bus at any convenient point.



#### 2.1 GYRO MODULE MOUNTING

For best performance the Gyro Module should be mounted according to the following guidelines.

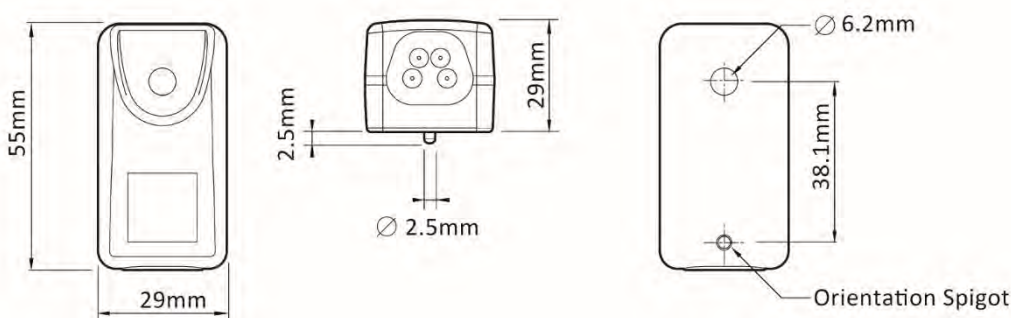
1. The Gyro Module must be mounted in a position on the chassis where impact is unlikely.
2. The Gyro Module must be mounted on a surface either perpendicular or parallel to the ground. In one of the 4 supported orientations (see programming - Orientation).
3. The Gyro Module must be bolted firmly to the chassis with the spigot located in a matching hole.

## 2.2 POSITION

The Gyro Module must be mounted in a position where it is not exposed to levels of water, dust, shock or vibration above those expected on a mobility application. The Gyro Module has been tested in accordance with ISO7176/14 with respect to these conditions. Contact Curtiss-Wright if you need further advice.

## 2.23 ORIENTATION

The Gyro Module should be mounted so that water cannot enter and remain in the connector recesses. The recommended mounting orientation is such that the Module is standing upright with the connectors pointing down. The function of the Gyro Module is sensitive to mounting orientation, therefore once mounted refer to the Programming section of this Chapter. The module has an IPX4 dust and water rating.



## 2.4 CONNECTIONS

There is one ReBus connector within the Gyro Module used for connection to the R-net system.

## 3 PROGRAMMING

The Gyro module gives the most comfortable results on a wheelchair that has already been set up to provide optimal performance and steering stability without Gyro control. The parameters that most affect general drive control are;

- Motor Compensation
- Maximum and Minimum Speed
- Acceleration
- Deceleration
- Front Wheel Drive Type
- Front Wheel Drive (%)

See the programming chapter on how to set these parameters.

The inclusion of a closed loop gyro control system can significantly increase the steering responsiveness of the wheelchair. Therefore, it is usually necessary to use lower **Turn Acceleration** and **Turn Deceleration** rates.

Further parameters that can help to keep the chair straight on Front Wheel Drive chairs are:

- \*FWD Acceleration Limit
- \*Advanced Electronic Stability
- \*AES Rate





*\*Not normally required with a Gyro Module installation and should be disabled during Gyro Module set up*

See the programming chapter for details on these parameters.

### 3.01 PARAMETER LIST

The Gyro Module parameters are held within their own programming group.

Gyro Module Fitted	<i>Sets whether the Gyro algorithms are active in the Power Module and enables checking for a Gyro signal</i>
Orientation	<i>Sets the expected mounting orientation for the module on the chair</i>
Gyro Error Speed Limit	<i>Sets the maximum speed of the wheelchair should a Gyro error be detected</i>
Angular Speed Scalar	<i>Calibrates the Gyro to a particular wheelchair configuration</i>
Proportional gain	<i>Sets the rate at which the Gyro will respond to fast changes in wheelchair direction</i>
Integral Gain	<i>Influences the straight tracking of a wheelchair to provide directional stability</i>
Dynamic Gain	<i>Sets whether the system uses 2 or all 4 Gain parameters to affect drive stability</i>
Low Speed Proportional Gain	<i>Sets the rate at which the Gyro will respond to fast changes in wheelchair direction at low speed</i>
Low Speed Integral Gain	<i>Influences the straight tracking of a wheelchair to provide directional stability at low speed</i>
Gyro Profile Select	<i>Sets the drive profiles in which closed loop Gyro control is active</i>

#### 3.1 GYRO MODULE FITTED

This parameter sets whether the Gyro algorithms are active in the Power Module and enables checking for a Gyro Signal.

The programmable options are Yes and No.

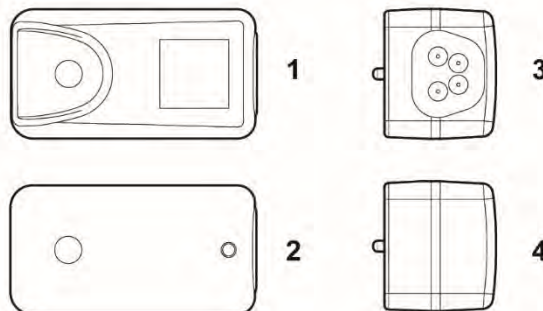
If set to Yes and the Gyro Module is not connected, then the wheelchair forward speed will be limited to the value set by Gyro Error Speed Limit.

If set to No and the Gyro Module is not fitted then no speed limit will be present

#### 3.2 ORIENTATION

Orientation sets the expected mounting of the Gyro Module viewed from above the wheelchair. There are 4 programmable options.

Viewed from above the chair





---

### 3.3 GYRO ERROR SPEED LIMIT

This parameter sets the maximum speed of the wheelchair should a Gyro error be detected. The programmable range is 0% to 100% in steps of 1%.

---

### 3.4 ANGULAR SPEED SCALAR

This calibrates the Gyro Module to a particular wheelchair configuration. This must be set up before any other Gyro Module parameters are adjusted.

The programmable range is 5-250.

---

### 3.5 PROPORTIONAL GAIN

This parameter affects the rate at which the gyro will respond to fast changes in wheelchair direction to provide stability. If the proportional gain is too low the steering response will be unresponsive and difficult to control. If the proportional gain is too high, steering control may be too aggressive and introduce steering overshoot.

The programmable range is 0 to 255 where 0 is a very slow response and 255 is a very fast response.

---

### 3.6 INTEGRAL GAIN

This parameter processes gyro information over a longer period of time and this value influences the straight tracking of a wheelchair to provide directional stability. The higher the value the stiffer the control, if the value is too high it will introduce steering overshoot and can introduce oscillation into the control loop.

The programmable range is 0 to 255 where 0 is a very slow response rate and 255 is a very fast response rate.

---

### 3.7 DYNAMIC GAIN

This parameter sets whether the system uses the parameters Proportional Gain and Integral Gain solely or a combination of Proportional Gain, Integral Gain, Low Speed Proportional Gain and Low Speed Integral Gain to control the wheelchairs drive stability. If this is set to No the Proportional Gain and Integral Gain are active across the entire speed range.

If set to Yes, Low Speed Proportional Gain and Low Speed Integral Gain are active just after entering drive. In this case all four Gain parameters are to achieve the best possible drive stability throughout the entire speed range.

---

### 3.8 LOW SPEED PROPORTIONAL GAIN

This parameter affects the rate at which the gyro will respond to fast changes in wheelchair direction when being driven at low speed.

The programmable range is 0 to 255 where 0 is a very slow response rate and 255 is a very fast response rate.

---

### 3.9 LOW SPEED INTEGRAL GAIN

This parameter processes gyro information over a longer period of time and this value influences the straight tracking of a wheelchair being driven at low speed. The programmable range is 0 to 255 where 0 is a very slow response rate and 255 is a very fast response rate.

Example:



It may be useful to use the low speed gains if a satisfactory drive feel cannot be achieved using the proportional and integral gains. For example if the wheelchair is overly responsive to joystick movements at low speeds or loses straight line performance at high speeds.

**CAUTION:**

The gain settings are subjective and will be influenced by the application in which the gyro system is used. For example, high gains will give faster steering corrections and good straight line tracking. Lower gains give a slower and smoother response and a more comfortable drive feel while still providing complete stability control to the wheelchair. However, straight line tracking may not be so good due to a slower gyro control response.

### 3.10 GYRO PROFILE SELECT

This sets whether gyro control is enabled within each of the Profiles.

The programmable options are Yes and No.

If set to Yes, then gyro control is enabled within that Profile.

If set to No, then gyro control is not enabled within that Profile.

**CAUTION:**

At least one Profile should be set to No, in order to allow the wheelchair to be used in a moving environments such as trains, busses or ships.

## 5 SET-UP OF THE GYRO MODULE

The set-up should be carried out by personnel with experience in the drive set-up of wheelchairs. With many of the parameters, the chosen value will depend on preference for the drive feel. It is recommended that an Emergency Stop button be fitted to the system and that drive testing commences at slow speeds.

**CAUTION:**

A standalone Gyro set up procedure for gyro set up is available from Curtiss-Wright applications department on request.

Name	Range	Default Value
Gyro Module Fitted	Yes/No	Yes
Gyro Error Speed Limit	0% to 100%	50%
Proportional Gain	0 - 255	70
Integral Gain	0 - 255	60
Dynamic Gains	Yes/No	No
Low Speed Proportional Gain	0 - 255	70
Low Speed Integral Gain	0 - 255	60
Gyro Profile Select	Yes/No	Yes

1. Set **Gyro Module Fitted** to No.
2. Select the correct **Orientation** number.
3. Set the Turn Speed relatively fast (e.g. 30-50 %).
4. Set the Forward and Reverse speeds to 5% max, 1% min.
5. Attach the wheelchair to a PC programmer via the R-net dongle.
6. Run the R-net Programmer application and view the Angular Speed Scalar reference in the Gyro Status window.



Sit in the wheelchair and apply full turn demand for at least 5s, then remove the demand to stop the turn.

#### CAUTION:

During this process traction must be maintained otherwise an erroneous value for the Angular Speed Scalar Reference value will be obtained. Either reduce the turn speed if necessary or carry out the test on a suitable non slip surface.

7. Record the **Angular Speed Scalar Reference** value from the Gyro Status window.
8. Repeat steps 6 and 7 above for the opposite turn direction, and average the 2 results.
9. Program the **Angular Speed Scalar** parameter with the calculated result.
10. Now the **Gyro Module Fitted** option may be set to Yes and the Proportional and Integral gains can be programmed.
11. Tune the Proportional and Integral Gains as required.
12. Enable the dynamic gains and tune (optional)
13. Select an appropriate **Gyro Error Speed Limit** value.
14. Select a non gyro drive profile using the **Gyro Profile Select** parameter.

## 5.1 VERIFICATION OF SET-UP

Once the Gyro Module has been set-up as described above, it is important to thoroughly test the settings in different environments to ensure optimum gyro performance.

- a. Test driving over loose or slippery surfaces to ensure direction is maintained.
- b. Test driving on uneven pavements.
- c. Test driving with one drive wheel on and one off of a grass surface.
- d. Test driving by pushing the wheelchair sideways, chair should maintain course.
- e. Test driving across pavements with drop curbs chair should maintain course

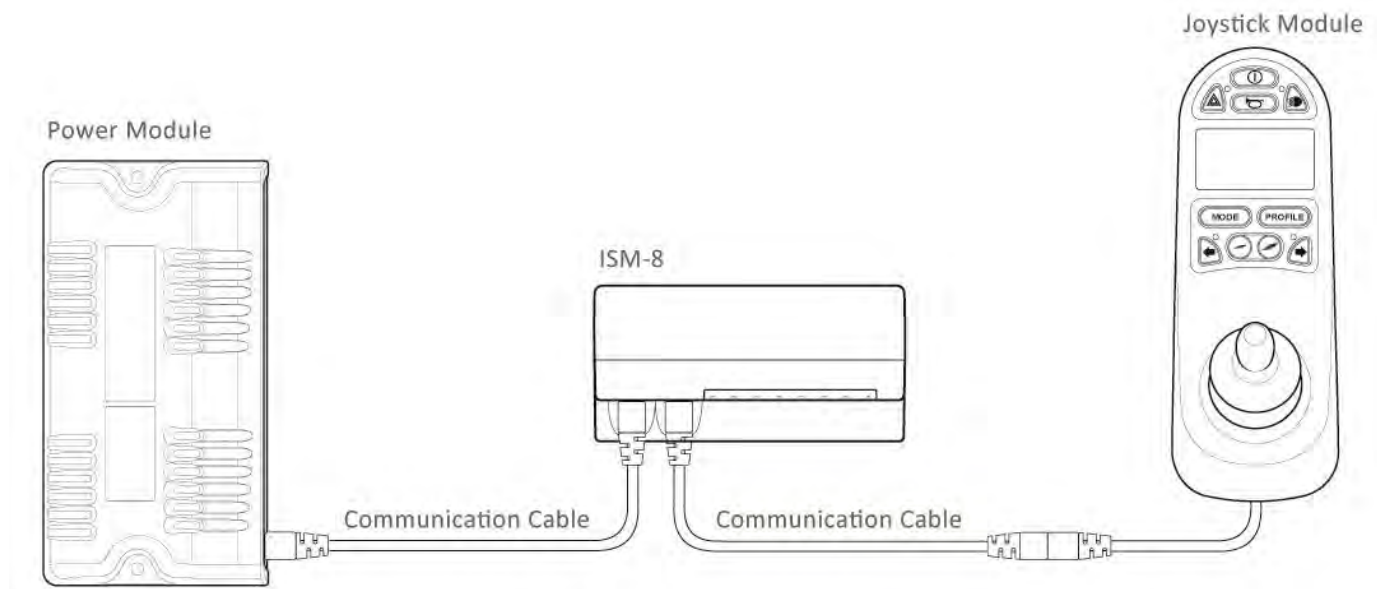
## CHAPTER 8 – ISM-8

### 1 INTRODUCTION

The R-net Intelligent Seating Module-8 (ISM-8) is an actuator module that offers advancements over the existing R-net ISM. The ISM-8 allows simultaneous channel operation with independent direction control.

### 2 INSTALLATION

An ISM-8 can be fitted at any point within a R-net Control System. See following diagram.



#### CAUTION:

It is possible to set up a Control System so that it is unsuitable for some users or even some vehicles. For all of the above reasons it is important that you contact Curtiss-Wright if you have the slightest doubts or if you need any advice on programming.

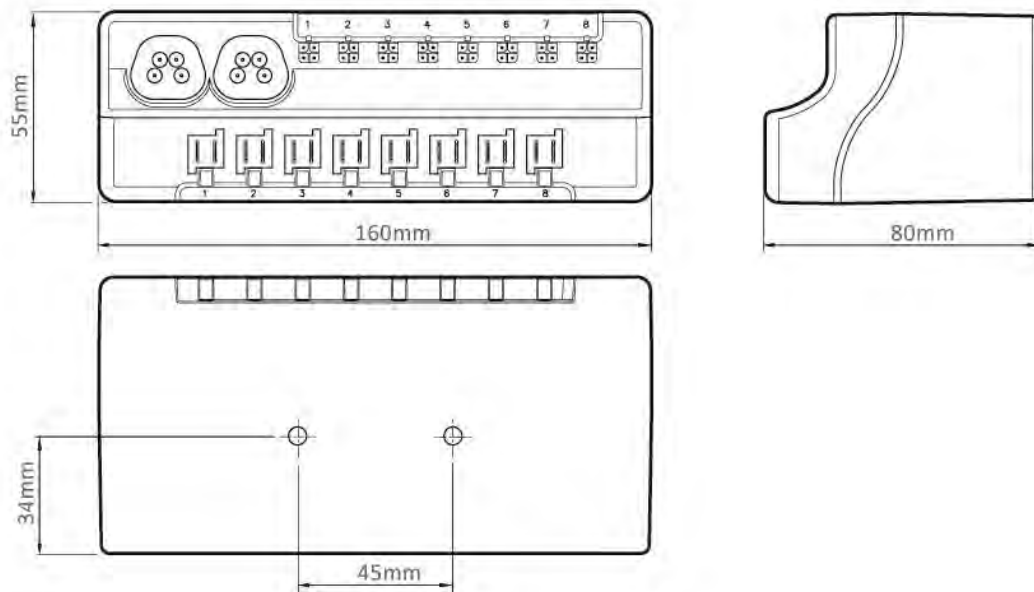
#### WARNING:

Programming and diagnostics should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic Control Systems. Incorrect programming could result in an unsafe setup of a vehicle for a user. Curtiss-Wright accept no liability for any losses of any kind if the programming of the Control System is altered from the factory-preset values.

### 3 MOUNTING

#### 3.1 ORIENTATION

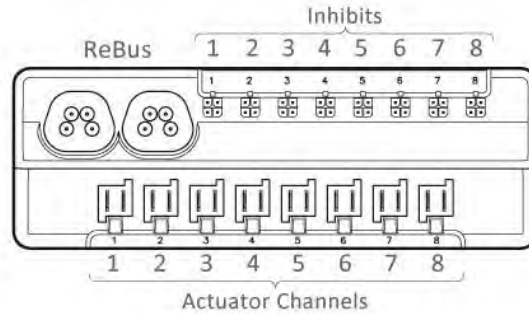
The function of the ISM-8 is not sensitive to mounting orientation; however, it should be mounted in such a way that water cannot enter and remain in the connector recesses. It is recommended that the unit is not mounted with the connectors uppermost. The ISM-8 has an IPX4 moisture resistance rating.



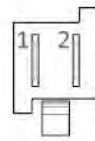
#### 3.2 POSITION

The ISM-8 must be mounted in a position where it is not exposed to conditions of water or dust above those specified in ISO7176/9. The LM is designed to withstand levels of shock and vibration experienced when mounted to the chassis of a wheelchair. Direct impacts onto the unit should be avoided.

## 4 CONNECTIONS



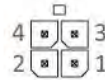
### Actuators



Joystick Movement	Pin 1	Pin 2	Actuator Movement	
Forward	-ve	+ve	Channel Up	*
Backward	+ve	-ve	Channel Down	*

\* Assumes no Joystick Orientation programming has been undertaken

### Inhibits



	1	2	3	4	5	6	7	8
PIN	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION	FUNCTION
1	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V
2	GND	GND	GND	GND	GND	GND	GND	GND
3	INHIBIT 18	INHIBIT 20	INHIBIT 22	INHIBIT 24	INHIBIT 26	INHIBIT 28	INHIBIT 30	INHIBIT 32
4	INHIBIT 19	INHIBIT 21	INHIBIT 23	INHIBIT 25	INHIBIT 27	INHIBIT 29	INHIBIT 31	INHIBIT 33

### 4.1 R-NET REBUS

#### WARNING:

The Bus connections can only be used to connect the ISM-8 to an R-net Control System using Curtiss-Wright supplied R-net Communication Cables. Curtiss-Wright accept no liability for any losses of any kind if an incorrect cable is used.

### 4.2 INHIBITS

The ISM-8 contains Inhibit 18 to 33 connections. These connections can be used to limit speed, inhibit drive and/or inhibit actuator channels. Refer to Section 5 – Programming for full details.

Signals to the Inhibit connector can be passive, i.e. A resistor varying from 0Ω to 10kΩ, or active, i.e. a voltage source varying from 0V to 3.3V.



The Inhibit connections are accommodated in 8 4-way connectors with each connector also containing 5V and 0V supply connections for active sensors. The maximum current output the ISM-8 can supply from its voltage source is 300mA, spread in any combination across the 8 pins.

### 4.3 ACTUATORS

Each actuator channel is rated at 15A maximum, although only 12A is available when the channel is programmed to 100% speed. If currents of greater than 12A are required, the programmed speeds for that channel must be reduced. The level of reduction is dependent upon the electrical characteristics of the actuator motor, so an empirical process to establish the level of the reduction is required.

If the wheelchair is fitted with solid mechanical end-stops at the end of the actuator travel, it is not necessary to fit limit switches as the ISM-8 can detect when the actuator motor has stopped and will cut off the power to it.

## 5 PROGRAMMING

### 5.1 PARAMETERS

The ISM-8 parameters are held within the programming groups of Seating and Inhibits. Within the two groups there are individual branches called ISM-8/CxSM which hold all of the relevant parameters.

#### Seating/

##### Global

- Actuator End Stop Bleep Sets whether a bleep occurs when an actuator channel is automatically end-stopped
- Actuator Mode Entry Axis Sets the default axis when Seating Mode is entered

##### Axes Setup

- Axis Channels Sets which actuator motor channels on the ISM will operate for a particular axis
- Axis Display Sets the user display for a particular axis
- Invert Channel Direction Inverts the direction of a Channel within an Axis

##### Channels

- Acceleration Sets the acceleration for each actuator channel
- Deceleration Sets the deceleration for each actuator channel
- Up Speed Sets the speed in the up direction for each actuator channel
- Down Speed Sets the speed in the down direction for each actuator channel
- Up Current Limit Sets the maximum current output in the up direction for each actuator channel
- Down Current Limit Sets the maximum current output in the down direction for each actuator channel
- Endstop Autodetect Sets if the automatic endstop function for a particular actuator channel operates
- Actuator Endstop Timeout Sets the period of time before the drive is cut at an endstop position

#### Inputs

##### Inputs - ISM-8

- Lower Level Threshold Sets the threshold between Band 0 and Band 1 for a particular Inhibit Input on the ISM
- Middle Level Threshold Sets the threshold between Band 1 and Band 2 for a particular Inhibit Input on the ISM
- Upper Level Threshold Sets the threshold between Band 2 and Band 3 for a particular Inhibit Input on the ISM
- Debounce Time Sets a debounce time for the inhibit input
- Inhibit Type Sets the Inhibit input to accept a signal from either an active or passive sensor.

##### Actuator Inhibits Channel 'x'

- Up: Assign Links the software inhibits to an actual hardware inhibit
- Up: Inhibit in Bands Sets the condition of the input that will result in an inhibit of an actuator channel in the up direction
- Up: Alarm Sets whether an audible alarm will sound when an actuator channel is inhibited in the up direction
- Up: Inhibit Active in Axis Sets the Axes in which the Inhibit is active
- Down: Assign Links the software inhibits to an actual hardware inhibit





Down: Inhibit in Bands

Down: Alarm

Down: Inhibit Active in Axis

Sets the condition of the input that will result in an inhibit of an actuator channel in the down direction

Sets whether an audible alarm will sound when an actuator channel is inhibited in the down direction

Sets the Axes in which the Inhibit is active

## 5.2 SEATING

### ISM-8 – STANDARD - GLOBAL

#### ACTUATOR AXES EXPLAINED

An actuator axis means a particular function of seat control. An axis may involve just one actuator motor, for example, a simple seat lift; or an axis may involve multiple motors, for example, adjustment of both footrests simultaneously or an anti-shear recline system. There are 8 actuator motor channels on the ISM-8 and an axis can combine any number of these channels.

The default ISM-8 application can support up to 12 actuator axes. Each is programmable to define which actuator motors move and also how the user display appears. The relevant parameters are Axis Channels and Axis Display.

#### 5.2.1 ACTUATOR END STOP BLEEP

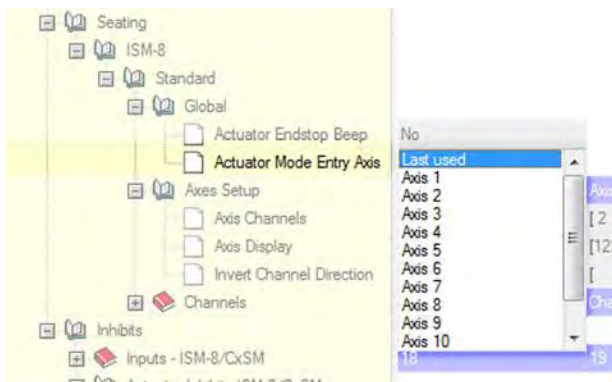
This allows the use of an Audible bleep to tell you when the Actuator is stalled at its end stop.

This parameter can be set to On or Off.

#### 5.2.2 ACTUATOR MODE ENTRY AXIS

This sets the actuator axis that is selected when Seating Mode is entered.

The programmable options are in the form of a drop-down menu, as shown in the following diagram.



Simply select the required axis. If Last used is selected, this means the axis that was selected on the last occasion Seating Mode was used will be the selected axis when Seating Mode is re-entered.

## ISM-8 – AXIS SETUP

### 5.2.3 AXIS CHANNELS, AXIS DISPLAY, INVERT AXIS DIRECTION AND AXIS NAME

These parameters set:

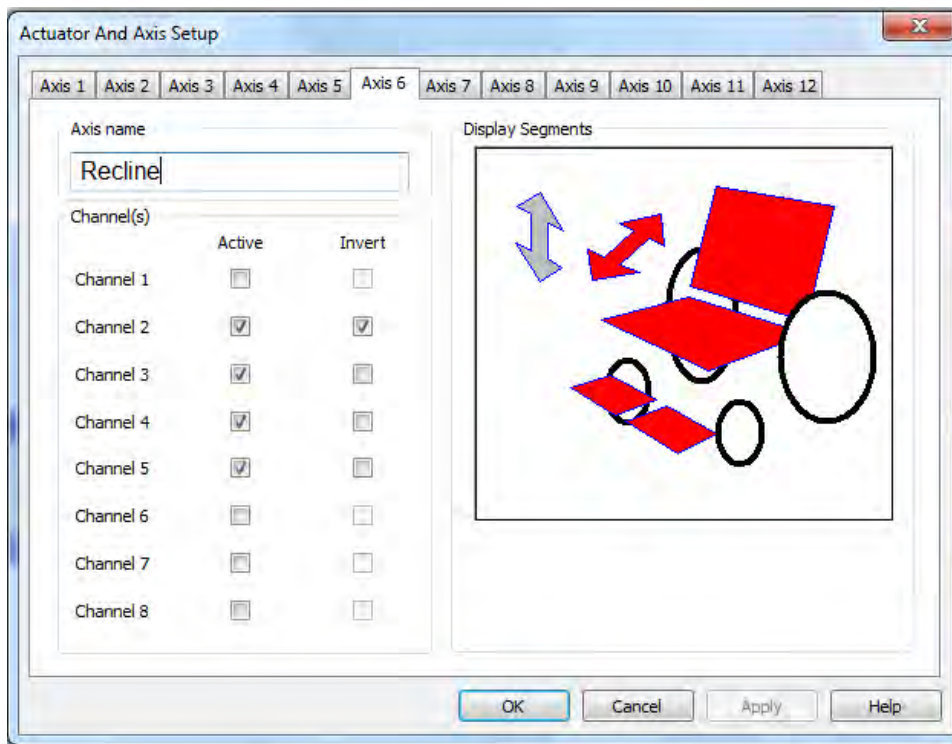
Which actuator motor channels on the ISM-8 will operate for a particular axis.

The user display for a particular axis.

Whether a channel direction is inverted for a particular axis.

Sets the text to be displayed on the LCD when the associated Actuator Axis is selected.

These options are in the form of a dialogue box, as shown in the following example diagram.



In this example, Axis 6 is the Axis that is being set-up. With the programming as shown: Channels 2, 3, 4 and 5 will operate in this Axis; the direction of Channel 2 is inverted, i.e. when the joystick is deflected forwards, the channel outputs will have pin 2 negative with respect to pin 1; and the Joystick Module will highlight those areas colored in red.

#### NOTE:

**The outline of the whole wheelchair symbol is always present on the user display, but with the elements highlighted as defined in red. However, if the arrow symbols are not defined in red, they will not appear on the display.**

When the dialogue box is closed, the programming is expressed as follows:



ISM-8/CxSM					
Standard					
Global					
Axis Setup					
Axis Channels					
Axis Display					
Invert Channel Direction					

Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
[ 1 ]	[ 2 ]	[ 3 ]	[ 4 ]	[ 5 ]	[ 2345 ]
[ 1 ]	[12345]	[1 3456]	[ 5 ]	[ 4 ]	[12345]
[ ]	[ ]	[ ]	[ ]	[ ]	[ 2 ]

## 5.2.4 AXIS NAME

This parameter sets what text will be displayed on the LCD when the associated Actuator Axis is selected.

This is only applicable on Color Joystick Modules and the Omni.

## ISM-8 – CHANNELS

## 5.2.4 ACCELERATION

This sets the acceleration rate for a particular ISM-8 channel.

Programmable range is 1 to 100 in steps of 1.

### WARNING:

**This parameter must be set to 100% on systems that use automatic endstops, i.e. those that do not use micro-switches at the end of actuator travel. If the value is not set to 100%, then the automatic endstop function will not operate and damage to the actuator motor or the wheelchair frame may occur.**

## 5.2.5 DECELERATION

This sets the deceleration rate for a particular ISM-8 channel.

Programmable range is 1 to 100 in steps of 1.

### WARNING:

**This parameter must be set to 100% on systems that use automatic endstops, i.e. those that do not use micro-switches at the end of actuator travel. If the value is not set to 100%, then the automatic endstop function will not operate and damage to the actuator motor or the wheelchair frame may occur.**

## 5.2.6 UP SPEED

This sets the speed of a particular ISM-8 channel in the Up direction.

Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Axis Direction is not set.

Programmable range is 25% to 100% in steps of 1%.



### 5.2.7 DOWN SPEED

This sets the speed of a particular ISM-8 channel in the Down direction.

Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Axis Direction is not set.

Programmable range is 25% to 100% in steps of 1%.

### 5.2.8 UP CURRENT LIMIT

This sets the maximum current output for a particular ISM-8 channel in the Up direction.

Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Axis Direction is not set.

The maximum current the ISM-8 can deliver is 15A. However, this can only be achieved if the channel's Up Speed is less than 100%. At a setting of 100% speed, the maximum current is 12A. The actual speed setting that is required is dependent on the electrical characteristics of the actuator motor being driven. Therefore, if currents of greater than 12A are required, the speed settings should be gradually reduced until reliable actuator movement is attained.

Programmable range is 0.5A to 15A in steps of 0.1A.

This parameter can be important if automatic endstop detection is employed. Automatic endstopping relies on the actuator mechanism being held against a firm mechanical stop at the end of travel. However, some mechanisms may distort over time due to the high endstop force. This force can be effectively reduced by reducing the value of this parameter.

#### NOTE:

**The value must not be set so low that it cannot move the maximum rated load for the actuator mechanism, or does not account for wear and increased friction in the mechanism.**

### 5.2.9 DOWN CURRENT LIMIT

This sets the maximum current output for a particular ISM-8 channel in the Down direction.

Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Axis Direction is not set.

The maximum current the ISM-8 can deliver is 15A. However, this can only be achieved if the channel's Down Speed is less than 100%. At a setting of 100% speed, the maximum current is 12A. The actual speed setting that is required is dependent on the electrical characteristics of the actuator motor being driven. Therefore, if currents of greater than 12A are required, the speed settings should be gradually reduced until reliable actuator movement is attained.

Programmable range is 0.5A to 15A in steps of 0.1A.

This parameter can be important if automatic endstop detection is employed. Automatic endstopping relies on the actuator mechanism being held against a firm mechanical stop at the end of travel. However, some mechanisms may distort over time due to the high endstop force. This force can be effectively reduced by reducing the value of this parameter.

#### NOTE:

**The value must not be set so low that it cannot move the maximum rated load for the actuator mechanism, or does not account for wear and increased friction in the mechanism.**



### 5.2.10 ENDSTOP AUTODETECT

This enables or disables the automatic endstop function for a particular actuator channel. Automatic endstop detection is a technique that uses actuator motor current to detect if an endstop has been reached. Upon detection, drive to the actuator motor is automatically cut. This technique removes the need for micro-switches at end limits.

The programmable options are Yes and No.

#### NOTE:

**Automatic endstop can only be used with actuator Acceleration and Deceleration values of 100%. Automatic endstop may not work well if the actuator takes a very low current.**

### 5.2.11 ACTUATOR ENDSTOP TIMEOUT

This sets the amount of time the actuator motor current has to be above the endstop detection level (or actuator current limit if Endstop Autodetect is set to No) before the drive is cut. It is actually very rare to have to adjust this parameter, but it can be useful to prevent nuisance stopping, i.e. false detections of endstop.

The programmable range is 0 milliseconds to 500 milliseconds in steps of 10 milliseconds.

### 5.2.12 COMPLEX SEATING MODULE-CUSTOM

This is the branch designated for customer specific programming parameters. This branch will be used where the ISM-8 has been customized by a wheelchair OEM to offer specific functionality that is different to what is delivered as standard by PG. These parameters will need to be defined in conjunction with Curtiss-Wright.

## 5.3 INHIBITS

### INHIBITS EXPLAINED

The ISM-8 has 16 Inhibit Inputs, these are number 18-33. For connection details of these inputs, please refer to the Section 4 - Connections.

Each of these inputs can recognize four different input conditions (or states). This means that four different events can originate from a single input. The input can either be a resistive (passive) or a voltage source (active).

If the Inhibit Type parameter is set to Passive, then the associated inhibit input will be scaled to an analogue range of 0-100 where 0 represents 0 Ohm to Gnd and 100 represents 10 K Ohms to Gnd.

If the Inhibit Type parameter is set to Active, then the associated inhibit input will be scaled to an analogue range of 0-100 where 0 represents 0V at the input and 100 represents 3.3V at the input.

See the following Speed Inhibit and Actuator Inhibit Examples assume a resistive input.

The state of an Inhibit input is defined as a percentage and is set by the resistance connected to the input.

If the input is connected directly to 0V, then it is considered to be at 0%.

If the input is connected to 0V via a 10 K Ohms resistor or greater, then it is considered to be at 100%.

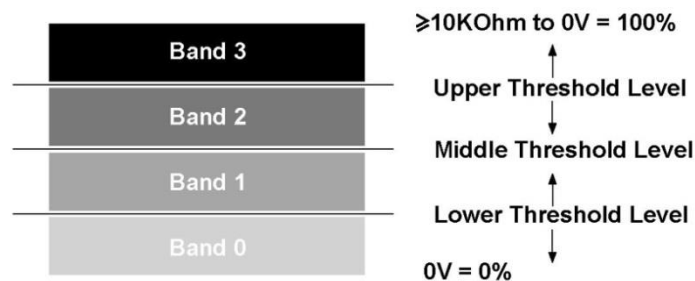
Each of the 99 steps between corresponds to 100Ohm. As an example, if the input is connected to 0V via a 4.7KOhm resistor, then the input is considered to be at 47%.

Dependent on the state of an input, it is in one of four bands. The size of these bands is programmable via the parameters Lower Level Threshold, Middle Level Threshold and Upper Level Threshold. These are shown in the following diagram.

Each of the Threshold Level parameters can be set between 0% and 100% in steps of 1%.

After the input bands have been defined, then each input can be linked to a speed limit or full drive inhibit via the parameters: Assign, Speed Limit in Band 0, Speed Limit in Band 1, Speed Limit in Band 2 and Speed Limit in Band 3.

Assign, Speed Limit in Bands 0, 1, 2 and 3 as Operation.



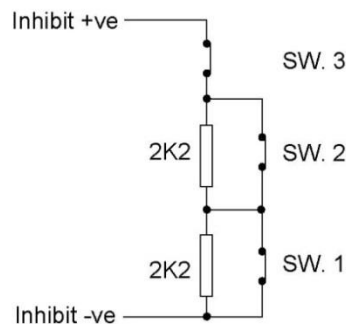
Each input can also be linked to an actuator function via the parameters: Assign, Channel x Up: Inhibit in Bands and Channel x Down: Inhibit in Bands.

## SPEED INHIBIT EXAMPLE

Application: A wheelchair with an elevating seat, whereby, when the seat is lowered, full speed drive is permitted. Then as the seat raises, 3 switches are operated, thereby changing the resistance connected to the input and giving, say, 50% speed limit to 25% speed limit to full drive inhibit.

In this example the Inhibit is connected to Inhibit 18 input that is sited on the ISM-8.

A circuit such as follows is used.



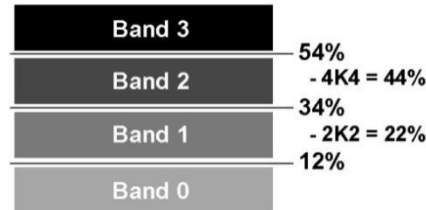
The Inhibit input must be assigned to a specific software Inhibit. As this is a speed inhibit, the parameter Drive Inhibits Assign should be used. Inhibit 18 input is therefore assigned to Drive Inhibit A.

When the seat is in the fully lowered position, all switches are closed and the electrical resistance is a short-circuit or 0 Ohms. As the seat raises, SW1 opens giving 2.2KOhms, then SW2 opens giving 4.4KOhms and at full height SW3 opens giving a complete open-circuit

Programming would be as follows:

Inputs ISM-8 - Threshold Levels:	
Upper Level Threshold	54%
Middle Level Threshold	34%
Lower Level Threshold	12%

This gives a band arrangement as follows.



As good practice, the threshold limits have been chosen so the actual resistance values that trigger a change are in the approximate center of the bands, thereby eliminating the risk of a system erroneously switching between bands.

The 4 Speed Limits for Drive Inhibit A would need to be set as below:

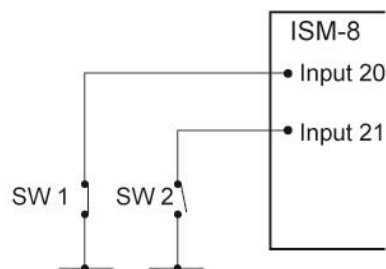
Inhibit A:

Speed Limit in Band 0	100%	Speed Limit in Band 1	50%
Speed Limit in Band 2	25%	Speed Limit in Band 3	0%

#### Actuator Inhibit Examples

Application 1: A wheelchair is fitted with a reclining backrest that has endstop switches connected to the R-net's Inhibit inputs 20 and 21 on the ISM-8. In this example the switches are installed to be normally closed and the Backrest has been programmed to use Actuator Channel 2.

A circuit such as follows is used.

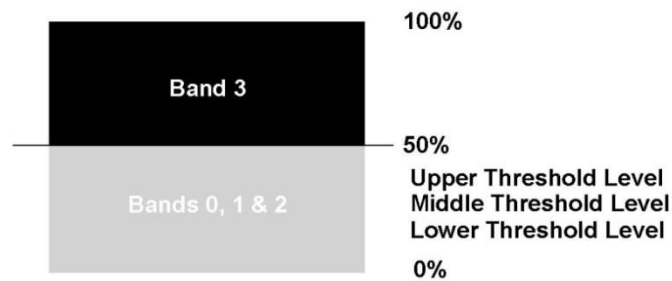


The Inhibit input must be assigned to a specific software Inhibit. As this is an Actuator Inhibit, the parameters Actuator Inhibits Channel X - Up: Assign & Down: Assign should be used.

The inputs are therefore assigned to Actuator Inhibits Channel 2 as follows:

Up: Assign - Input 20
Down: Assign - Input 21

As these inputs are connected to the ISM-8 the Threshold levels must be set in the parameter Inputs - ISM-8.



When Actuator Inhibits Channel 2 is programmed in the following way the inhibit will effectively stop the backrest actuator being moved in the Up direction when Switch 1 is open and in the Down direction when Switch 2 is open.

Up: Assign 20

Inhibit in Band 0 no  
Inhibit in Band 1 no  
Inhibit in Band 2 no  
Inhibit in Band 3 yes

Down: Assign 21

Inhibit in Band 0 no  
Inhibit in Band 1 no  
Inhibit in Band 2 no  
Inhibit in Band 3 yes

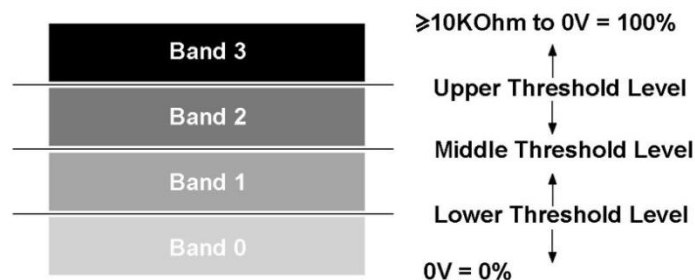
Application 2: A wheelchair is fitted with a reclining seat. It is required to offer a programmable angle of recline to suit different users. A potentiometer of maximum value 10KOhm is fitted to the recline mechanism and is connected to the R-net's Inhibit 20 input sited on the ISM-8. In this example the Backrest has been programmed to use Actuator Channel 3.

The Inhibit input must be assigned to a specific software Inhibit. As this is an Actuator Inhibit, the parameters Actuator Inhibits Channel 3 - Up: Assign & Down: Assign should be used.

The inputs are therefore assigned to Actuator Inhibits Channel 3 as follows:

Up: Assign - Input 20  
Down: Assign - Input 20

As these inputs are connected to the ISM-8 the Threshold levels must be set in the parameter Inputs - ISM-8.



By programming the Actuator Channel 3 Up Inhibit and Actuator Channel 3 Down Inhibit parameters as below, it is possible to program the maximum angle of travel of the recline mechanism via the Inhibit 20.

Actuator Channel 3

Up: Assign 20

Inhibit in Band 0 yes  
Inhibit in Band 1 no  
Inhibit in Band 2 no  
Inhibit in Band 3 no

Down: Assign 20

Inhibit in Band 0 no  
Inhibit in Band 1 no  
Inhibit in Band 2 no  
Inhibit in Band 3 yes





This programming means that the Up movement will be inhibited when the Inhibit20 input is in Band 0, i.e. one end of recline travel, and that the Down movement will be inhibited when the Inhibit4 input is in Band 3, i.e. the other end of the recline travel. Referring the Band diagram above, it can be seen that by programming ISM-8 Upper Level Threshold and ISM-8 Lower Level Threshold, then the actual angular range of the recline mechanism is adjusted.

## ISM-8 – INPUTS

### 5.3.1 LOWER LEVEL THRESHOLD

This sets the level of the threshold between Band 0 and Band 1 for a particular Inhibit Input on the ISM-8. See Inhibits Explained for more details on ISM-8 inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

### 5.3.2 MIDDLE LEVEL THRESHOLD

This sets the level of the threshold between Band 1 and band 2 for a particular Inhibit Input on the ISM-8. See Inhibits Explained for more details on ISM-8 inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

### 5.3.3 UPPER LEVEL THRESHOLD

This sets the level of the threshold between Band 2 and band 3 for a particular Inhibit Input on the ISM-8. See Inhibits Explained for more details on ISM-8 inhibits and bands.

The programmable range is 0% to 100% in steps of 1%.

### 5.3.4 DEBOUNCE TIME

This sets a debounce time for the Inhibit input. Debounce is the amount of time the input must be stable before a new condition is registered. This is particularly useful if mercury switches are being employed and eliminates the effect of “splashing” across the contacts.

The programmable range is 0ms to 4000ms in steps of 50ms.

### 5.3.5 INHIBIT TYPE

The ISM-8 has 16 inhibit inputs assigned number 18 to 33. Each Inhibit input can be set to accept a signal from either an active or passive sensor.

If set to Active, then a voltage signal in the range 0-3.3V will be expected, where 0V equates to 0% and 3.3V equates to 100%.

If set to Passive then a 10kOhm variable resistor will be expected, where 0Ohm equates to 0% and 10kOhm equates to 100%.



## ISM-8 – ACTUATOR INHIBITS - CHANNEL 'X' (X = 1 TO 8)

### 5.3.6 CHANNEL X – UP: ASSIGN

The R-net ISM-8 has 3 separate software inhibits for the up direction of each of its output channels, 1 to 8. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Channel Direction is not set. These inhibits are referred to as A, B and C; and each can be initiated by any actual hardware input in the system. This functionality means that any actuator channel direction can be inhibited from 3 individual sources.

The parameter, Assign, links the software inhibits to an actual hardware inhibit. For example, if Assign:A is set to 18, then the operation of Channel x Up Inhibit will be controlled via Inhibit Input 18, which are on the ISM-8.

The programmable options are Off, 2, 3 and 18 to 33.

If set to Off, then the relevant Channel x Up Inhibit can never be active.

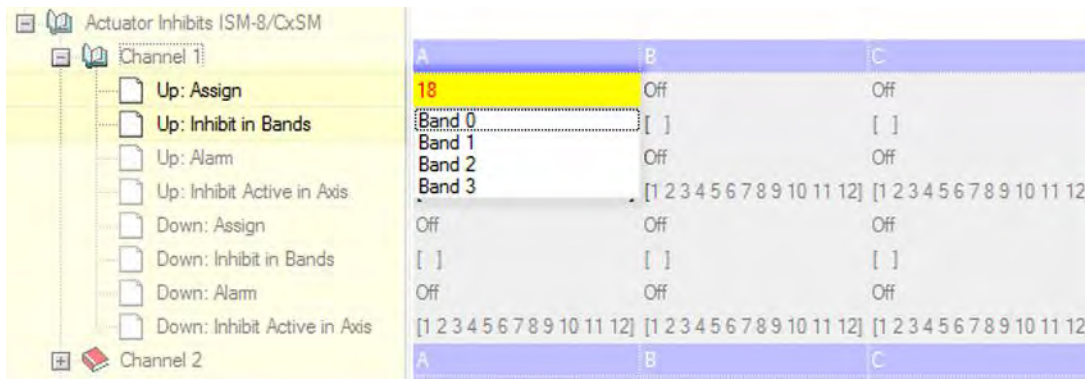
If set to a numeric value, then the relevant Channel x Up Inhibit will be under the control of the Inhibit Input that corresponds to that number. Inhibit Inputs 2 and 3 are on the Power Module and Inhibits 18 to 33 will be on the ISM-8.

### 5.3.7 CHANNEL X – UP: INHIBIT IN BANDS

This sets the condition of the input (assigned to Channel x Up Inhibit) that will result in an inhibit of the actuator drive in the up direction. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Channel Direction is not set. The inhibit can be set to occur in any combination of bands. See Inhibits Explained for more details on Bands.

The programmable options are Band 0, Band 1, Band 2 and Band 3.

If the parameter is selected, then a drop down menu as below will appear and the bands required to invoke the inhibit should be selected. For example, if the inhibit is required for Band 3 only, then that option should be selected, as shown.



When the drop down menu is closed, it would appear as below.



Actuator Inhibits ISM-8/CxSM			
Channel 1			
Up: Assign	18	Off	Off
Up: Inhibit in Bands	[ 3 ]	[ ]	[ ]
Up: Alarm	Off	Off	Off
Up: Inhibit Active in Axis	[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]
Down: Assign	Off	Off	Off
Down: Inhibit in Bands	[ ]	[ ]	[ ]
Down: Alarm	Off	Off	Off
Down: Inhibit Active in Axis	[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]
Channel 2			
A B C			

### 5.3.8 CHANNEL X – UP: ALARM

This sets whether an audible alarm will sound when a channel's up direction is inhibited. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Channel Direction is not set.

The programmable options are On and Off.

If set to On, then an alarm will sound while an inhibit is present.

If set to Off, then no alarm will sound.

### 5.3.9 CHANNEL X – UP: INHIBIT ACTIVE IN AXIS

The ISM-8 has three separate software Inhibits for each direction of each of its output Channels, 1 to 8. These inhibits are referred to as A, B and C; and each can be initiated by any actual hardware input in the system. This functionality means that any actuator Channel direction can be inhibited from three individual sources.

Channel X, Up: Inhibit Active in Axis sets whether the software Inhibit is active in a particular Axis.

If all twelve Axes are selected the software Inhibit will be active in all available Axes.

If Up: Inhibit: Inhibit Active in Axis is programmed to a subset of Axes 1-12, the software Inhibit will only be active in the selected Axes.

In the example below, Channel 1 Up direction is inhibited (using software Inhibit A) when Inhibit 18 input is in Band 3. However, this Inhibit function is only required in Axes 1 and 2, so Channel 1 Up: Inhibit Active in Axis (A) is set to 1,2.

Actuator Inhibits ISM-8/CxSM			
Channel 1			
Up: Assign	18	Off	Off
Up: Inhibit in Bands	[ 3 ]	[ ]	[ ]
Up: Alarm	Off	Off	Off
Up: Inhibit Active in Axis	[1 2 ]	[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]

### 5.3.10 CHANNEL X – DOWN: ASSIGN

The R-net ISM-8 has 3 separate software inhibits for the up direction of each of its output channels, 1 to 8. Up is defined as pin 2 positive with respect to pin 1 when the joystick is displaced forward and Invert Channel Direction is not set. These inhibits are referred to as A, B and C; and each can be initiated by any actual hardware input in the system. This functionality means that any actuator channel direction can be inhibited from 3 individual sources.



The parameter, Assign, links the software inhibits to an actual hardware inhibit. For example, if Assign:A is set to 18, then the operation of Channel x Up Inhibit will be controlled via Inhibit Input 18, which is located on the ISM-8.

The programmable options are Off, 2, 3 and 18 to 33.

If set to Off, then the relevant Channel x Up Inhibit can never be active.

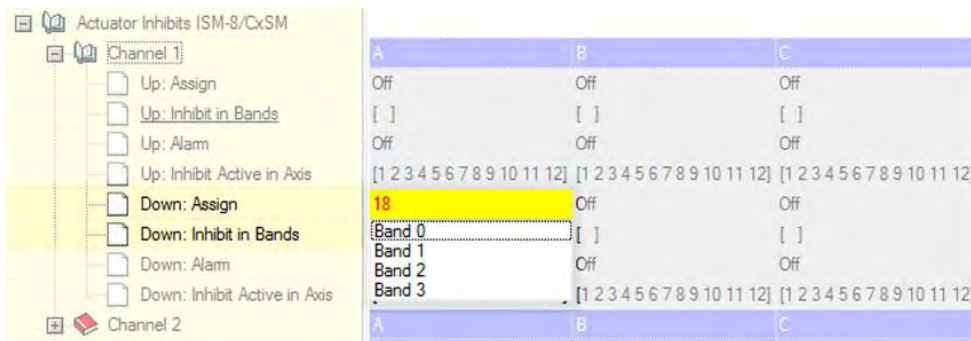
If set to a numeric value, then the relevant Channel x Up Inhibit will be under the control of the Inhibit Input that corresponds to that number. Inhibit Inputs 2 and 3 are on the Power Module and Inhibits 18 to 33 are on the ISM-8.

### 5.3.11 CHANNEL X – DOWN: INHIBIT IN BANDS

This sets the condition of the input (assigned to Channel x Down Inhibit) that will result in an inhibit of the actuator drive in the down direction. Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Channel Direction is not set. The inhibit can be set to occur in any combination of bands. Inhibits Explained for more details on bands.

The programmable options are Band 0, Band 1, Band 2 and Band 3.

If the parameter is selected, then a drop down menu as below will appear and the bands required to invoke the inhibit should be selected. For example, if the inhibit is required for Band 3 only, then that option should be selected, as shown.



When the drop down menu is closed, it would appear as follows.



### 5.3.12 CHANNEL X – DOWN: ALARM

This sets whether an audible alarm will sound when a channel's down direction is inhibited. Down is defined as pin 1 positive with respect to pin 2 when the joystick is displaced in reverse and Invert Channel Direction is not set.

The programmable options are On and Off.



If set to On, then an alarm will sound while an inhibit is present.

If set to Off, then no alarm will sound.

### 5.3.13 CHANNEL X – DOWN: INHIBIT ACTIVE IN AXIS

The ISM-8 has three separate software Inhibits for each direction of each of its output Channels, 1 to 8. These inhibits are referred to as A, B and C; and each can be initiated by any actual hardware input in the system. This functionality means that any actuator Channel direction can be inhibited from three individual sources.

Channel X, Down: Inhibit Active in Axis sets whether the software Inhibit is active in a particular Axis.

If all twelve Axes are selected the software Inhibit will be active in all available Axes.

If Down: Inhibit: Inhibit Active in Axis is programmed to a subset of Axes 1-12, the software Inhibit will only be active in the selected Axes.

In the example below, Channel 1 Down direction is inhibited (using software Inhibit A) when Inhibit 18 input is in Band 3. However, this Inhibit function is only required in Axes 1 and 2, so Channel 1 Up: Inhibit Active in Axis (A) is set to 1,2.

Channel 2		A	B	C
Up: Assign		Off	Off	Off
Up: Inhibit in Bands		[ ]	[ ]	[ ]
Up: Alarm		Off	Off	Off
Up: Inhibit Active in Axis		[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]
Down: Assign		19	Off	Off
Down: Inhibit in Bands		[ 3 ]	[ ]	[ ]
Down: Alarm		Off	Off	Off
Down: Inhibit Active in Axis		[ 3 4 ]	[1 2 3 4 5 6 7 8 9 10 11 12]	[1 2 3 4 5 6 7 8 9 10 11 12]



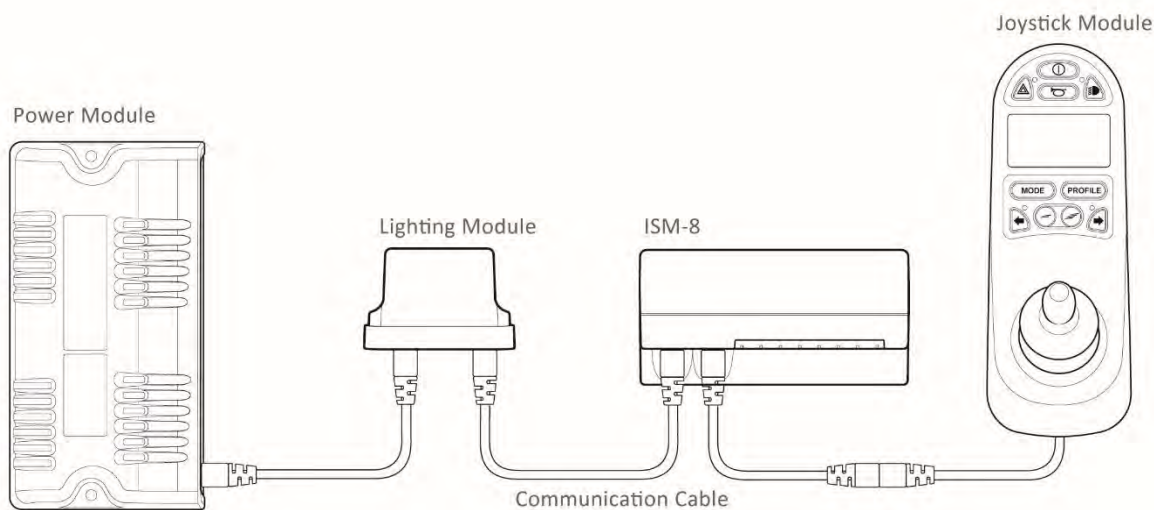
## CHAPTER 9 – LIGHTING MODULE (LM)

### 1 INTRODUCTION

The R-net Lighting Module (LM) provides control of lights, turn indicators and hazard lamps.

### 2 INSTALLATION

An LM can be fitted at any point within the R-net Control System. See following diagram for a typical example.



#### CAUTION:

It is possible to set up a Control System so that it is unsuitable for some users or even some vehicles. For all of the above reasons it is important that you contact Curtiss-Wright if you have the slightest doubts or if you need any advice on programming.

#### WARNING:

Programming and diagnostics should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic Control Systems. Incorrect programming could result in an unsafe setup of a vehicle for a user. Curtiss-Wright accept no liability for any losses of any kind if the programming of the Control System is altered from the factory-preset values.

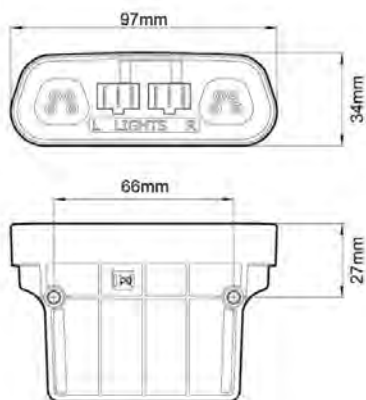
## 3 MOUNTING

### 3.1 GENERAL

The LM should be secured using four M5 screws with a maximum penetration of 7mm. Be careful not to over tighten the screws.

### 3.1 ORIENTATION

The function of the LM is not sensitive to mounting orientation; however, it should be mounted in such a way that water cannot enter and remain in the connector recesses. It is recommended that the unit is not mounted with the connectors uppermost. The LM has an IPX4 moisture resistance rating.

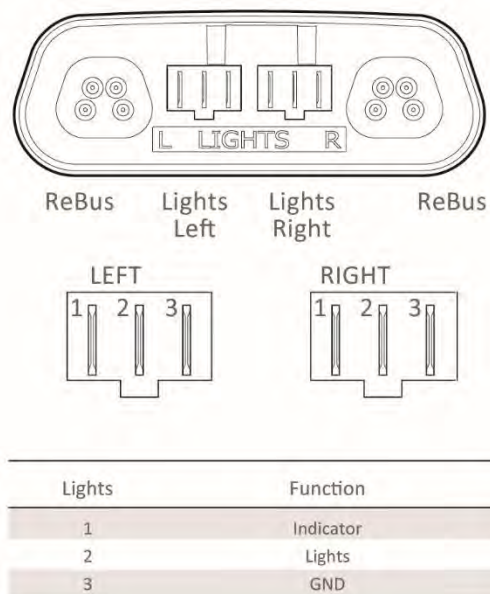


### 3.2 POSITION

The LM must be mounted in a position where it is not exposed to conditions of water or dust above those specified in ISO7176/9. The LM is designed to withstand levels of shock and vibration experienced when mounted to the chassis of a wheelchair. Direct impacts onto the unit should be avoided.



## 4 CONNECTIONS



Use only CW D51643 lighting module connector kit.

### R-NET REBUS

#### **WARNING:**

The Bus connections can only be used to connect the LM to an R-net Control System using Curtiss-Wright supplied R-net Communication Cables. Curtiss-Wright accept no liability for any losses of any kind if an incorrect cable is used.

## 5.0 PROGRAMMING

### POWER MANAGEMENT EXPLAINED

Because the module will be used in conjunction with other R-net system modules such as the ISM-8 or CxSM it is required to ensure that a total maximum R-net bus current is never exceeded. It is necessary to announce the current consumption of the lighting functions on the R-net bus. This is done by setting the Lights Power and Indicator Power parameters (see below).

### 5.1 LAMP VOLTAGE

This sets the operating voltage for the wheelchair's lighting system.

The programmable options are 12V and 24V. The wheelchair's light and indicators should be fitted with lamps of the corresponding value.

If set to 12V, then the lights and indicators will remain a constant brightness, whilst the battery voltage is above this level.

If set to 24V, then the brightness of the lamps and indicators will vary with fluctuations in the battery voltage.

#### **NOTE:**

**TÜV Germany requires the 12V constant brightness condition.**



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## 5.2 LIGHT POWER

This should be programmed to match the total power of all the bulbs in the lighting circuits.

The programmable range is 1W to 42W in steps of 1W.

---

## 5.3 INDICATOR POWER

This should be programmed to match half the total power of all bulbs in the turn-indicators circuits. Note: the values should correspond to half because the turn indicators always flash at a duty cycle of 50%

The programmable ranges is 1W to 42W in steps of 1W.

---

## 5.4 INDICATOR FAULT POWER

This sets the power threshold for single indicator bulb failure detection.

### NOTE:

**TÜV Germany requires that 2 x 21W lamps per side are used for the turn indicators.**

With Indicator Fault Detection set to Yes, If the total power drawn from the indicator output is less than the value programmed, the indicator shall be considered to be faulty. The parameter Indicator Fault Power is programmable from 0.5W to 50W in steps of 0.25W. For example, if 2 x 21W bulbs are fitted to each channel it is recommended to set this power threshold at approximately 30W.



## CHAPTER 10 – DIAGNOSTICS

### 1 INTRODUCTION

The primary objective of this chapter is to assist service personnel in finding the likely area of a detected trip within the whole wheelchair electrical system. It is important to realize that even though the control system is signalling a trip, it may not be the control system itself that is defective. This is because the control system is able to detect problems in other electrical components (motors, batteries, solenoid brakes, etc.) or, more importantly, the wiring to them. When a control system has detected a trip, a system trip is indicated.

This chapter covers the diagnostic process when working with an LCD based JSM or a DTT. If just a JSM-LED is being used, refer to section Control System Status Indication in Chapter 4.

#### **WARNING:**

**Diagnostics should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic control systems. An incorrect or badly effected repair could result in an unsafe set-up of a wheelchair. Curtiss-Wright accepts no liability for losses of any kind arising from an incorrect or badly effected repair.**

#### 1.1 DIAGNOSTIC PROCEDURE

To diagnose a trip please follow this procedure:

- Read and note the Trip Text displayed, the Identified Module and the Trip Code. Refer to section 2.
- Switch off the control system.
- Make sure that all connectors on the listed Module and the wheelchair are mated securely.
- Check the condition of the battery.
- Find the definition of the Trip Text, and take the required action. Refer to section 3.
- Switch on the control system again and try to drive the wheelchair. If the safety circuits operate again, switch off and do not try to use the wheelchair.
- Contact your service agent.

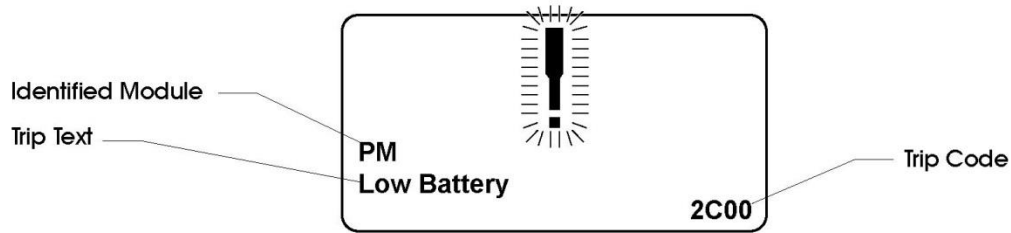
### 2 DIAGNOSTIC SCREENS

#### 2.1 CURRENT DIAGNOSTIC SCREEN

When the control system safety circuits have operated and the control system has been prevented from moving the wheelchair a diagnostics screen will be displayed.

This indicates a system trip, i.e. the R-net has detected a problem somewhere in the wheelchair's electrical system.

If the error is in a non-active module, for example in the ISM but with a Drive Mode selected, then drive will still be possible, however, the diagnostic screen will appear intermittently.



### 2.1.1 IDENTIFIED MODULE

This identifies which module of the control system has registered the problem, such:

PM	Power Module
JSM	Joystick Module
ISM	Intelligent Seating/lighting Module

### 2.1.2 TRIP TEXT

The Trip Text gives a brief description of the trip type.

### 2.1.3 TRIP CODE

The 4 digit code displayed gives the exact trip that has been recorded.

### 2.1.4 EXAMPLE

The example screen shown in section 2.1 shows the following information

Identified Module	Power Module
Trip Text	Low Battery
Trip Code	2C00

This means the battery needs charging or there is a bad connection to the battery.

- Check the connections to the battery. If the connections are good, try charging the battery.

## 2.2 SYSTEM LOG SCREEN

All trips are stored in the system log, whether they have been resolved or are still active. The system log stores the Trip Text and the number of occurrences. The trips are stored in their respective Modules within the system. The system log can be accessed using OBP, a Diagnostic Test Tool or the R-net PC Programmer.

Entering the System Log using OBP.

- Select System from the menu.
- Select Diagnostics from the menu.
- This displays the Diagnostic screen that shows the connected modules and the version history. See diagram below.



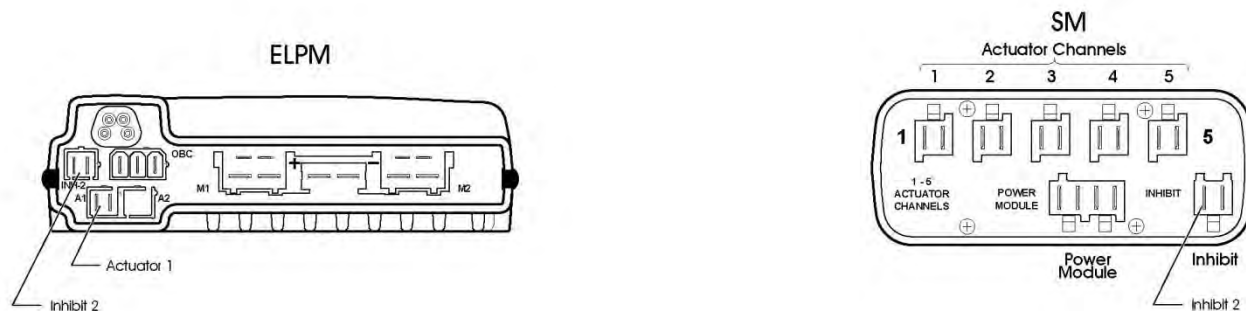
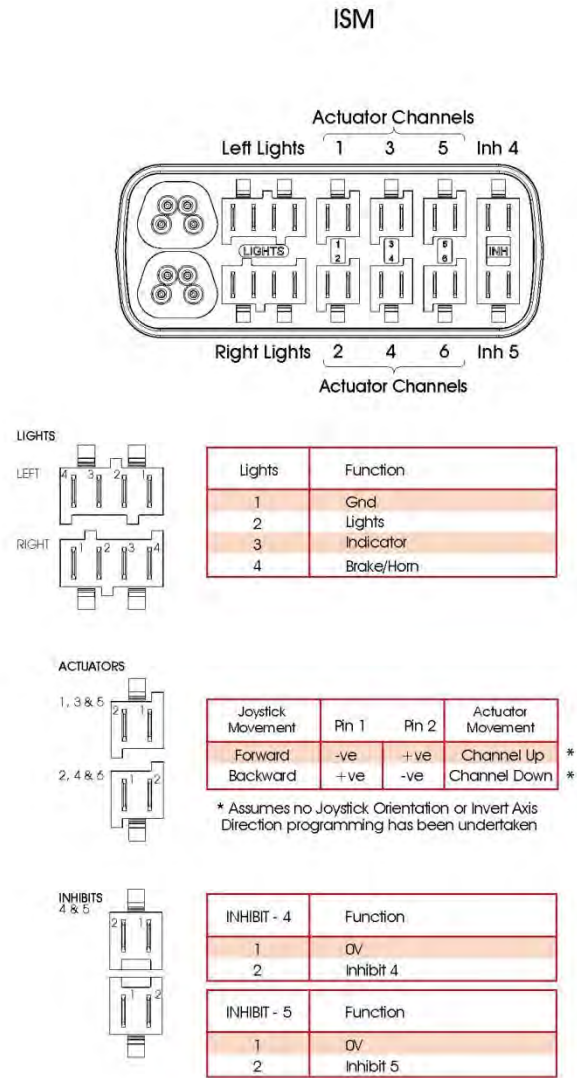
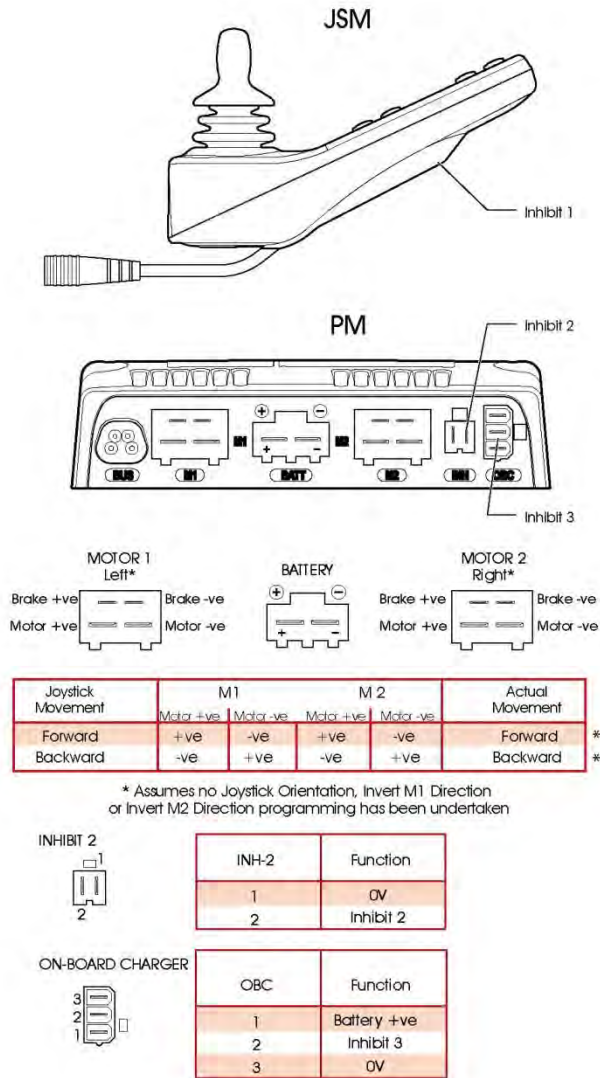
- If a Module has had no trips then the message No Entries will be displayed, otherwise something similar to the following screen will be displayed.

Diagnostics	
JSM	1.9
PM	1.9
ISM	1.9

PM 1.9	
M1 Brake Error	2
System Error	1

## 2.3 CONNECTIONS

The R-net has various connections that are referred to by the diagnostic text. These connections can be on the Power Modules (PM + ELPM), Joystick Modules (JSM + JSM LED) and the Seating Modules (LM, SM + ISM). The following diagram shows the connections on these Modules.

**WARNING:**

The R-net has 5 Inhibit connections within these 3 Modules, but programming allows for multiple inhibit connections to be added in further Curtiss-Wright and 3rd party Modules. For details of these inhibit connections refer to the Wheelchair Manufacturers documentation.



### 3 DIAGNOSTIC TEXT DEFINITIONS

Once a trip text and module have been established use the following definitions to ascertain the possible cause and required corrective procedure.

Trip Text	Referral Point
Center Joystick	Refer to section 3.1
Joystick Error	Refer to section 3.1
Low Battery	Refer to section 3.2
High Battery	Refer to section 3.3
M1 Brake Error	Refer to section 3.4
M2 Brake Error	Refer to section 3.4
M1 Motor Error	Refer to section 3.5
M2 Motor Error	Refer to section 3.5
Inhibit Active	Refer to section 3.6
Jstick Cal Error	Refer to section 3.7
Brake Lamp Short	Refer to section 3.8
Left Lamp Short	Refer to section 3.9
Right Lamp Short	Refer to section 3.9
L Ind Lamp Short	Refer to section 3.10
R Ind Lamp Short	Refer to section 3.10
L Ind Lamp Failed	Refer to section 3.11
R Ind Lamp Failed	Refer to section 3.11
Over-current	Refer to section 3.12
Overtemp. (Acts)	Refer to section 3.13
Overtemp. (Lamps)	Refer to section 3.14
DIME Error	Refer to section 3.15
Memory Error	Refer to section 3.16
PM Memory Error	Refer to section 3.17
Bad Cable	Refer to section 3.18
Bad Settings	Refer to section 3.19
Module Error	Refer to section 3.20
System Error	Refer to section 3.21
SID Detached	Refer to section 3.22
Switch Detached	Refer to section 3.23
Gone to Sleep	Refer to section 3.24
Charging	Refer to section 3.25
M1 Sensor Error	Refer to section 3.26
M2 Sensor Error	Refer to section 3.26
EM disconnected	Refer to section 3.26
JS Static Timeout	Refer to section 3.27
Orientation Error	Refer to section 3.28
ASM Disconnected	Refer to section 3.29
Gyro Disconnected	Refer to section 3.30
Gyro Prf Active	Refer to section 3.31
Switch Short	Refer to section 3.33



---

### 3.1 CENTER JOYSTICK

The most common cause of this trip is if the joystick is deflected away from center before and during the time the control system is switched on. The joystick displaced screen will be displayed for 5 seconds, if the joystick is not released within that time then a trip is registered.

- Ensure that the joystick is centered and power-up the control system.

If the trip is still present then the joystick or Joystick Module may be defective.

#### CAUTION:

**Depending on the Wheelchair Manufacturer's service agreement, the joystick may be replaced as a separate part. Otherwise refer to section 5.**

---

### 3.2 LOW BATTERY

This occurs when the control system detects that the battery voltage has fallen below 16V.

- Check the condition of the batteries and the connections to the control system.

If the trip is still present after the batteries and connections have been checked, then the Power Module may be defective. Refer to section 5.

---

### 3.3 HIGH BATTERY VOLTAGE

This occurs when the control system detects that the battery voltage has risen above 35V. The most common reasons for this are overcharging of the battery or bad connections between the control system and the batteries.

- Check the condition of the batteries and the connections to the control system.

If the trip is still present after the batteries and connections have been checked, then the Power Module may be defective. Refer to Section 5.

---

### 3.4 BRAKE ERROR

This occurs when the control system detects a problem in the solenoid brakes or the connections to them.

1505 - M1 Brake Error - Refer to section 2.3 for connection details

1506 - M2 Brake Error - Refer to section 2.3 for connection details

- Check the solenoid brakes, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the Power Module may be defective. Refer to Section 5.

---

### 3.5 MOTOR ERROR

This occurs when the control system detects that a motor has become disconnected.

3B00 - M1 Motor Error - Refer to section 2.3 for connection details

3C00 - M2 Motor Error - Refer to section 2.3 for connection details

- Check the motors, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the Power Module may be defective. Refer to Section 6.





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### 3.6 INHIBIT ACTIVE

This occurs when any of the Inhibit inputs are active and in a latched state.

The actual inhibit that is active is indicated by the last 2 digits in the Trip Code. The code is in Hex.

- 1E01 - For Inhibit 1 – Off-Board Charger is connected. Refer to section 2.3 for connection details.
- 1E20 - For Inhibit 2 - Refer to section 2.3 for connection details
- 1E21 - For Inhibit 3 - Refer to section 2.3 for connection details
- 1E22 - For Inhibit 4 - Refer to section 2.3 for connection details
- 1E23 - For Inhibit 5 - Refer to section 2.3 for connection details

- Cycle the power. This will drop out of Latched Mode that might clear the trip.
- Check all wiring and switches connected to the indicated Inhibits.

If the trip is still present after the above checks have been made, then the PM or ISM may be defective. Refer to Section 5.

---

### 3.7 JOYSTICK CALIBRATION ERROR

This occurs when the Joystick Calibration process has not been successful.

- Enter OBP and attempt calibration.

If the trip is still present after the above has been attempted, then the Joystick Module may be defective. Refer to Section 5.

---

### 3.8 BRAKE LAMP SHORT

This occurs when the control system detects a short in the Brake Lamp Circuit. Refer to section 2.3 for connection details.

- Check the brake lamps, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the ISM may be defective. Refer to Section 5.

---

### 3.9 LAMP SHORT

This occurs when the control system detects a short in either of the Lamp Circuits. Refer to section 2.3 for connection details.

- 7205 - Left Lamp Short
- 7209 - Right Lamp Short

- Check the lamps, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the ISM may be defective. Refer to Section 5.

---

### 3.10 INDICATOR LAMP SHORT

This occurs when the control system detects a short in either of the Indicator Circuits. Refer to section 2.3 for connection details.

- 7206 - Left Indicator Short
- 720A - Right Indicator Short

- Check the indicators, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the ISM may be defective. Refer to Section 5.



---

### 3.11 INDICATOR LAMP FAILED

This occurs when the control system detects a failure in either of the Indicator Circuits. This is most likely to be an indicator bulb failure. Refer to section 2.3 for connection details

- 7207 - Left Indicator Failed
- 7208 - Right Indicator Failed

- Check the indicator bulbs, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the ISM may be defective. Refer to Section 5.

---

### 3.12 OVER-CURRENT

This occurs when the control system detects an excessive amount of current in an Actuator Channel.

This may be due to a faulty endstop switch, actuator motor, cables or connections.

- Check the movement of the actuator is not obstructed.
- Check the endstop switches (if fitted) are terminating the power to the actuator motor.

If the trip is still present after the above checks have been made, then the SM or ISM may be defective. Refer to Section 5.

---

### 3.13 OVERTEMP (ACTS)

This occurs when the control system detects that the SM or ISM's actuator circuitry has become too hot. The control system will cease drive to the actuator motor in question.

- Allow the SM or ISM to cool.
- If the SM or ISM is frequently overheating check the condition of the actuator motors and the connections to them.
- If the trip persists contact your service agent.

---

### 3.14 OVERTEMP (LAMPS)

This occurs when the control system detects that the ISM's lighting circuitry has become too hot. The control system will cease supplying current to the lamp in question.

- Allow the ISM to cool.
- If the ISM is frequently overheating check the condition of all the connected bulbs and lamps.
- If the trip persists contact your service agent.

---

### 3.15 DIME ERROR

This occurs when the control system detects an identification conflict between two modules in the system.

If a new module has been introduced:

- Disconnect the new module and cycle the power.
- If no trip is present connect the new module to the system and cycle the power.
- If the trip reappears then the new module must be the cause of the problem.



If there have been no additions:

- Disconnect one module at a time and cycle the power.

If the trip is still present after the above checks have been made, contact your service agent.

---

### 3.16 MEMORY ERROR

This is a non-specific memory error that could be caused by any of the modules within the system.

- Check all cables and connections.
- Cycle the power.

If the trip is still present and the system contains 3rd Party Modules:

- Disconnect all the non-Curtiss-Wright modules and cycle the power.

If this has cleared the trip:

- Connect each 3rd Party Module in turn, cycling the power each time.
- If the trip reappears after one of the power cycles then the last module to have been added to the system must be defective.

If the trip is still present after the above checks have been made, then the PM may be defective. Refer to Section 5.

---

### 3.17 PM MEMORY ERROR

This is a specific Power Module based trip.

- Check all cables and connections.
- Using the R-net PC Programmer, re-program the control system.

This should be done with either the most current specific program file for the wheelchair or the manufacturer's original programming file.

#### **WARNING:**

**Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Curtiss-Wright accepts no responsibility for losses of any kind if the programming of the control system is altered from the factory pre-set values.**

If the trip is still present after the above checks have been made, then the PM may be defective. Refer to Section 5.

---

### 3.18 BAD CABLE

This occurs when the control system detects a fault in the wiring in the communication cables between any of the modules.

- Check all cables and connections for continuity.
- If there is any visible damage to cables, replace and cycle power.
- Disconnect one cable from the system at a time cycling the power after each disconnection.

If the trip is still present after the above checks have been made, then the PM may be defective. Refer to Section 5.



### 3.19 BAD SETTINGS

This occurs when the control system detects incorrect or invalid program settings.

- Check all parameter settings and re-program the control system using the R-net PC Programmer.
- Make a note of the current parameter settings and then reset the control system to default settings.
- Re-program the required settings in small groups, cycling the power after each group to see if the trip occurs.

If the trip is still present after the above checks have been made, then the PM may be defective. Refer to Section 5.

#### **WARNING:**

**Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Curtiss-Wright accepts no responsibility for losses of any kind if the programming of the control system is altered from the factory pre-set values.**

### 3.20 MODULE ERROR

This occurs when the control system detects a trip within a specific module. The module will be identified on the diagnostics screen as described in section 2.

- Check all cables and connections.
- Cycle the power.

If the trip is still present after the above checks have been made, then the module identified may be defective. Refer to Section 5.

### 3.21 SYSTEM ERROR

This occurs when the system detects a trip that cannot be attributed to a specific module.

- Check all cables and connections.
- Cycle the power.

If the trip is still present and the system contains 3rd Party Modules:

- Disconnect all the non-Curtiss-Wright modules and cycle the power.

If this has cleared the trip:

- Connect each 3rd Party Module in turn, cycling the power each time.
- If the trip reappears after one of the power cycles then the last module to have been added to the system must be defective.

If the trip is still present after the above checks have been made, then the Curtiss-Wright control system may be defective. Refer to Section 5.



---

### 3.22 SID DISCONNECTED

The Omni has detected that the Specialty Input Device (SID) has become disconnected.

- Check all cables and connectors between the Omni and the SID.

If the error persists:

- Check that the setting of the parameter, 9-Way Detect, is appropriate for the SID that is being used. For example, if the SID has no detect-link, then this parameter should be set to Off.

If the trip is still present after the above checks have been made, then the Input Device may be defective. Contact your service agent.

---

### 3.23 SWITCH DETACHED

This occurs when the CISM2 or Omni has detected that either of the External Switch Jack Sockets has become disconnected.

The actual Switch that has become disconnected is indicated by the Trip Code. The code is in Hex.

- 1E07 - External Profile/Mode Switch jack socket
- 1E08 - External On/Off Switch jack socket.

- Check the operation of the switch and all cables and connectors between the CISM2 and the switch.

If the trip is still present after the above checks have been made, then the switch or the CISM2 may be defective. Refer to Section 5.

#### **WARNING:**

**Because a disconnected User Switch means there is no emergency stop function, Curtiss-Wright recommend that Switch Detect for this option is always set to On. Curtiss-Wright will accept no liability for any losses resulting from any other setting of this parameter.**

---

### 3.24 GONE TO SLEEP

This occurs when the control system has been left inactive for a time greater than the parameter Sleep Timer.

An entry is made in the system log each time this occurs.

---

### 3.25 CHARGING

This occurs when the control system detects that a charger is connected to either Inhibit 1 or Inhibit 3. Refer to section 2.3 for connection details

The Battery charging screen will be displayed during charger connection.

An entry is made in the system log each time this occurs.

If an On-Board Charger is used:

- Disconnect the charger from the AC supply.

If an Off-Board Charger is used:

- Disconnect the charger from the Wheelchair.

If the trip is still present after the charger has been disconnected then the Joystick Module may be defective. Refer to Section 5.



---

### 3.26 ENCODER ERROR

This occurs when the control system detects an error with the Encoder Module or the Encoder Module has become disconnected

- 2001 - M1 Sensor Error – The power module cannot detect an Encoder module connection to M1
- 3C00 - M2 Sensor Error - The power module cannot detect an Encoder module connection to M2
- 7B01 - EM disconnected- The power module cannot detect an encoder module fitted when the parameter Encoder Module Fitted set to Yes

- Check the motors, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the Module may be defective. Refer to Section 5.

---

### 3.27 JOYSTICK STATIONARY TIME EXCEEDED

This occurs when the joystick is deemed to have been held stationary for an excessive period of time. The controller will stop drive to prevent possible damage the wheelchair's motors.

Turning the control system Off and On again will clear this error message.

If the trip is still present after the power has been cycled, then the Curtiss-Wright control system may be defective. Refer to Section 5.

---

### 3.28 ORIENTATION ERROR

This error occurs when the programmed orientation of the ASM does not match the actual mounted orientation.

Check the programming of the parameter Orientation against the actual mounting of the ASM.

If the trip is still present after the above checks have been made, then the ASM may be defective. Refer to Section 5.

---

### 3.29 ASM DISCONNECTED

This error occurs when the control system detects an error with the ASM or the ASM becomes disconnected.

Check the motors, cables and connections to the control system.

If the trip is still present after the above checks have been made, then the ASM may be defective. Refer to Section 5.

---

### 3.30 GYRO DISCONNECTED

This error occurs when the control system detects an error with the Gyro Module becomes disconnected.

Check all cables and connections between the Power Module connector and the Gyro Module and then cycle the power.

If the trip is still present after the above checks have been made, then the Gyro Module may be defective. Refer to Section 5.

---

### 3.31 GYRO PRF ACTIVE

This occurs when the controller detects a Gyro signal in standby on a moving vehicle such as a boat or a train.

Turn the controller off or select a non-gyro drive profile when using this type of transportation.

If the trip is still present after the above checks have been made, then the Gyro Module may be defective. Refer to Section 5.



### 3.32 SWITCH SHORT

This occurs when the CISM2 has detected that either of the External Switch Jack Sockets has a short-circuit.

The actual Switch that has the short-circuit is indicated by the Trip Code. The code is in Hex.

- 1E0D - External On/Off Switch jack socket.
- 1E0C - External Profile/Mode Switch jack socket

- Check the operation of the switch and all cables and connectors between the CISM2 and the identified switch.

If the trip is still present after the above checks have been made, then the switch or the CISM2 may be defective. Refer to Section 5.

## 4 BASIC TESTS

After a repair has been completed, the following tests should be carried out. These are minimum recommendations, depending on the nature of the original trip then additional tests may be required.

### **WARNING:**

**These tests are a minimum recommendation only. It is the responsibility of the service person(s) to perform other tests relevant to the original trip and wheelchair type. Refer to the wheelchair's Technical Manual for exact information of other tests. Curtiss-Wright accepts no liability for losses of any kind arising from the carrying out of the described tests, or from not carrying out additional relevant tests.**

**These tests should be conducted in an open space and a restraining device such as a seat belt should always be used. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.**

### 4.1 GENERAL INSPECTION

Make sure all connectors are securely mated.

- Check the condition of all cables and connectors for damage.
- Check the rubber gaiter or boot around the base of the joystick shaft for damage. Check visually only, do not handle the gaiter.
- Make sure that all components of the control system are securely mounted.
- Do not overtighten any securing screws.

### 4.2 BRAKE TEST

These tests should be carried out on a level floor with at least one meter clear space around the wheelchair.

- Switch on the control system.
- Check the screen remains on after initialization.
- Push the joystick slowly forwards until you hear the parking brakes operate. The wheelchair may start to move.
- Immediately release the joystick. You must be able to hear each parking brake operate within 2 seconds.
- Repeat the test a further three times, pushing the joystick slowly backwards, left and right.



#### 4.3 DRIVE TEST

With the maximum speed control in the minimum position, drive the wheelchair in all directions, ensuring the drive is comfortable and easy to control for the user.

Repeat the above but with the speed control set to maximum.

#### 4.4 GRADIENT TEST

**NOTE:**

**Before carrying out this test ensure another person is present to prevent the wheelchair from tipping backwards.**

Drive the wheelchair forwards up its maximum rated gradient. While on the gradient release the joystick and ensure the wheelchair comes to rest and the brakes are applied without the front wheels lifting off the ground.

Deflect the joystick forwards and continue driving up the slope. Ensure the pickup is smooth and positive.

Stop the wheelchair and reverse down the gradient. While on the gradient release the joystick and ensure the wheelchair comes to rest and the brakes are applied without the front wheels lifting off the ground.

#### 4.5 LIGHTS, INDICATORS AND HAZARD LAMPS TEST

If lights are fitted:

- Visually check each bulb for correct illumination.
- Check each indicator bulb for correct illumination and that the flash rate is  $1.5\text{Hz} \pm 0.5\text{Hz}$ .
- Disconnect each bulb in turn and check that the remaining bulb for that side flashes at  $3\text{Hz} \pm 0.5\text{Hz}$ .

If hazard lamps are fitted:

- Check each bulb for correct illumination and that the flash rate is  $1.5\text{Hz} \pm 0.5\text{Hz}$ .

#### 4.6 ACTUATOR TEST

If actuators are fitted:

- Check each motor for correct direction of movement.
- Ensure the mechanical end-stops are secure and that they stall the actuator motors, thus operating the ISM's automatic end-stop detection.

#### 4.7 INHIBIT INPUT TEST

Insert an appropriate battery charger, or equivalent inhibit connection, into the Charger Connector on the JSM and ensure that drive is inhibited.

If Inhibits 2, 3, 4 and 5 are used for inhibit or speed limiting purposes, suitable tests should be devised to ensure correct operation.





## 5 SERVICING OF DEFECTIVE UNITS

Excluding specific OEM approved replacement parts (for details of these contact the wheelchair manufacturer), there are no serviceable parts in the R-net control system. Consequently, any defective units must be returned to Curtiss-Wright or a Curtiss-Wright approved service organization for repair.

**WARNING:**

**Any replacement work carried out without the wheelchair manufacturer's permission will invalidate the control system's warranty.**

Opening or making any unauthorized adjustments or modifications to the R-net control system or its components will invalidate any warranty and may result in hazards to the vehicle user, and is strictly forbidden.

**WARNING:**

**Curtiss-Wright accepts no liability for losses of any kind arising from unauthorized opening, adjustments or modifications to any component of the R-net control system.**





## CHAPTER 11 – WARNING SUMMARY

### 1 INTRODUCTION

This section summarizes all of the very important warnings that appear throughout the text of this manual. Do not install, maintain or operate the machine without reading, understanding and observing the following warnings. Failure to observe these warnings could result in UNSAFE CONDITIONS for the user of a machine or affect the reliability of the control system. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with any of the conditions in the warnings listed below. Failure to observe these warnings will invalidate the R-Net warranty.

The machine manufacturer may wish to use this section as a check list, to ensure the risk areas identified below have been addressed within their own machine designs and associated documentation.

### 2 WARNINGS

#### 2.1 CHARGER SOCKET

**WARNING:**

The control system's warranty will be voided if any device other than a Curtiss-Wright. Programmer, or the battery charger supplied with the wheelchair, is connected into this socket. Chapter 1 Section 4.4.

#### 2.2 DRIVING TECHNIQUE

**WARNING:**

The wheelchair user must be capable of driving a wheelchair safely. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 8.2.

#### 2.3 HAZARDS

**WARNING:**

Although the R-Net control system is designed to be extremely reliable and each unit is rigorously tested during manufacture, the possibility of a system malfunction always exists (however small the probability). Under some conditions of system malfunction the control system must (for safety reasons) stop the chair instantaneously. If there is any possibility of the user falling out of the chair as a result of a sudden braking action, it is imperative that a restraining device such as a seat belt is supplied with the wheelchair and that it is in use at all times when the wheelchair is in motion. Curtiss-Wright accept no liability for losses of any kind arising from the unexpected stopping of the wheelchair, or arising from the improper use of the wheelchair or control system.

Do not operate the control system if the chair behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the control system off at once and consult your service agent. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Electronic equipment can be affected by Electro Magnetic Interference (EMI). Such interference may be generated by radio stations, TV stations, other radio transmitters and cellular phones. If the chair exhibits erratic behavior due to EMI, turn the



control system off immediately and consult your service agent. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

It is the responsibility of the chair manufacturer to ensure that the wheelchair complies with appropriate National and International EMC legislation. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The wheelchair user must comply with all wheelchair safety warnings. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 9.1.

---

## 2.4 BATTERY CHARGING

### **WARNING:**

Do not operate the control system if the battery is nearly discharged. Failure to comply with this condition may leave the user stranded in an unsafe position, such as in the middle of a road. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 11.

---

## 2.5 BATTERY CHARGING

### **WARNING:**

Do not exceed the maximum charging current of 12 A rms. Always use an off-board charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the charger plugs. This presents a potential burn hazard for the user. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the control system's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Only use the battery charger that has been supplied with your wheelchair. The use of incorrect chargers could damage the batteries, wheelchair, control system or charger itself, or may result in parts overheating creating the potential for burns or even fire. Curtiss-Wright accepts no liability for losses of any kind if the charger is incompatible with the control system (see Chapter 2, section 7) or any other part of the wheelchair system. Chapter 1 Section 12.

---

## 2.6 PROGRAMMING

### **WARNING:**

Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Curtiss-Wright accepts no liability for losses of any kind if the programming of the control system is altered from factory pre-set values. Chapter 1 Section 14.



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## 2.7 JOYSTICK KNOBS

### **WARNING:**

Do not replace the joystick knob with any unauthorized item. It may cause hazardous operation. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 15.

---

## 2.8 SERVICING

### **WARNING:**

Curtiss-Wright accepts no liability for losses of any kind arising from unauthorized opening, adjustment or modifications to the R-Net control system.

If the control system is damaged in any way, or if internal damage may have occurred through impact or dropping, have the product checked by qualified personnel before operating. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 section 16.

---

## 2.9 WARRANTY

### **WARNING:**

The warranty will be void if the R-Net has not been used in accordance with R-Net Technical Manual SK77981, the R-Net has been subject to misuse or abuse, or if the R-Net has been modified or repaired by unauthorized persons. Chapter 1 Section 17.

---

## 2.10 PROGRAM SETTINGS

### **WARNING:**

It is the manufacturer's responsibility to program the control system to suit the vehicle model and ensure safe operation in compliance with relevant legal requirements over the whole of the operating range. Curtiss-Wright accepts no liability for losses of any kind due to failure to, or incorrect programming or the R-net Control System. Refer to Chapter 3 for programming details.

Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic control systems. Incorrect programming could result in an unsafe setup of a wheelchair for the user. Curtiss-Wright accepts no liability for losses of any kind if the programming of the control system is altered from factory pre-set values. Curtiss-Wright accepts no liability for losses of any kind if the drive or stability characteristics of the chair are altered without prior notification and discussion with Curtiss-Wright. Chapter 2 section 1.2.

---

## 2.11 CHARGER INTERLOCK

### **WARNING:**

The chair manufacturer is responsible for providing a means of preventing the use of the wheelchair while the batteries are being charged. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 2.2.



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## 2.12 POWER MODULE WIRING - GENERAL

### **WARNING:**

The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair, for both normal use and stalled conditions. Curtiss-Wright can make general recommendations for wiring for R-Net control systems, but Curtiss-Wright accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used.

The chair manufacturer is responsible for ensuring that only the mating connectors specified by Curtiss-Wright on the control system's specific data sheet are used to connect to the control system. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the chair wiring system and that the workmanship associated with the wiring system is of a good enough quality. Failure to meet this condition could result in intermittent operation, sudden stopping or veering, or even create a burn or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 6.1.

---

## 2.13 CRIMPING

### **WARNING:**

Defective or poor quality crimps may affect the warranty of the control system. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 6.1.3.

---

## 2.14 WIRE GAUGE AND TYPES

### **WARNING:**

Battery and motor wires should have 105°C rated PVC insulation.

The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair. Curtiss-Wright can make general recommendations for wiring for R-net control systems, but Curtiss-Wright accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used. Chapter 2 Section 6.2.

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## 2.15 BATTERY CONNECTIONS

### **WARNING:**

The chair manufacturer must install a suitable circuit breaker to provide protection against short circuits in the battery wiring, power loom or the control system. Failure to comply with this could result in a fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 6.3.

---

## 2.16 BATTERY CHARGING

### **WARNING:**

Do not exceed the maximum charging current of 12A rms. Always use a charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the



charger plugs. This presents a potential burn hazard for the user. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the control system's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Examine all electrical appliances intended for use with the wheelchair, including the battery charger, regularly for damage, especially the cord, plug and enclosure. If the appliance is damaged, it must not be used until it has been repaired. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 7.1.

---

## 2.17 DRIVE MOTORS

### **WARNING:**

The chair manufacturer is responsible for ensuring that the control system is matched to the motor resistance. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for always ensuring that any replacement motors or gearboxes are fully compatible with the originals that the control system was designed to match. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

Users must not move a control system from one chair type to install it on a different chair type. Control systems with different part numbers may have both hardware and software differences to ensure that they are compatible with the electrical and dynamic characteristics of their specific target vehicles. The characteristics of one type of control system may not be compatible with a different, unauthorized chair. Failure to observe this warning could result in an unsafe setup for the wheelchair user and may create a fire hazard depending on the motors, wiring, connectors and circuit breakers installed on the unauthorized chair. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 section 8.

---

## 2.18 SOLENOID BRAKES

### **WARNING:**

It is essential that the control system is programmed for the correct brake voltage. If it is not, damage may occur to the brakes or the drive performance of the wheelchair may be affected. Chapter 2 section 9.

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## 2.19 INTRODUCTION

### **WARNING:**

Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Curtiss-Wright accept no responsibility for losses of any kind if the programming of the control system is altered from the factory pre-set values. Chapter 3 Section 1.



## HOW TO ENTER OBP MODE

### **WARNING:**

If the keycode method is set, then it may be possible for a wheelchair user to gain entry to the OBP function. Curtiss-Wright accept no liability for losses of any kind if this method of OBP is set. Curtiss-Wright also accept no liability for losses of any kind if OBP access is gained by unauthorised personnel obtaining a dongle. Chapter 3 Section 2.1.

## 2.21 TREMOR DAMPING

### **WARNING:**

If using high values of Tremor Damping, pay particular attention to the stopping distance of the wheelchair, as it will be increased. Chapter 3 Section 6.21.

## 2.22 EMERGENCY STOP SWITCH

### **WARNING:**

Curtiss-Wright accept no liability for losses of any kind resulting from the use of a wheelchair with latched drive or actuator operation and with no normally closed Emergency Stop Switch fitted. Chapter 3 Section 7.10.

## 7.23 EXTERNAL PROFILE JACK DETECT

### **WARNING:**

Curtiss-Wright recommend that if seat actuators are driven using this input and a single switch, then the switch must be fitted with a resistor as described above. Curtiss-Wright accept no liability for losses of any kind arising from the use of any other switch. Chapter 3 Section 7.16.

## 7.24 ON/OFF JACK DETECT

### **WARNING:**

Curtiss-Wright recommend the switch must be fitted with a resistor as described above. Curtiss-Wright accept no liability for losses of any kind arising from the use of any other switch. Chapter 3 Section 7.17.

## 2.25 OBP KEYCODE ENTRY

### **WARNING:**

If this parameter is set to Yes, then it may be possible for a wheelchair user to gain entry to the OBP function. Curtiss-Wright accept no liability for losses of any kind if this method of OBP is set. Curtiss-Wright also accept no liability for losses of any kind if OBP access is gained by unauthorised personnel obtaining a dongle. Chapter 3 Section 7.11.

## 2.26 LATCHED DRIVE

### **WARNING:**

Curtiss-Wright accept no liability for losses of any kind resulting from the use of a wheelchair with latched drive or actuator operation and with no normally closed Emergency Stop Switch fitted. Chapter 3 Section 8.1 & 8.2.





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## 2.27 LATCHED TIMEOUT

### **WARNING:**

Curtiss-Wright accept no liability for losses of any kind resulting from the use of a wheelchair with latched drive or actuator operation and with a Latched Timeout value of less than 2. Chapter 3 Section 8.3.

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## 2.28 ACTUATOR ACCELERATION

### **WARNING:**

This parameter must be set to 100% on systems that use automatic endstops, i.e. those that do not use micro-switches at the end of actuator travel. If the value is not set to 100%, then the automatic endstop function will not operate and damage to the actuator motor or the wheelchair frame may occur. Chapter 3 Section 9.4.

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## 2.29 ACTUATOR DECELERATION

### **WARNING:**

This parameter must be set to 100% on systems that use automatic endstops, i.e. those that do not use micro-switches at the end of actuator travel. If the value is not set to 100%, then the automatic endstop function will not operate and damage to the actuator motor or the wheelchair frame may occur. Chapter 3 Section 9.5.

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## 2.30 BRAKE FAULT DETECT

### **WARNING:**

This parameter should only ever be set to No if there are no electrical brakes fitted to the wheelchair. Chapter 3 Section 11.2.

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## 2.31 BRAKE VOLTAGE

### **WARNING:**

It is essential the correct value for the brakes' operating voltage is set. An incorrect value could result in damage to the brakes or motors. Curtiss-Wright accept no liability for losses of any kind resulting from incorrect programming of this parameter. Chapter 3 Section 11.3.

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## 2.32 SOFT STOP RATE

### **WARNING:**

It is the wheelchair manufacturer's responsibility to ensure that the wheelchair complies with the correct legislation for braking distances for the country in which the wheelchair is to be sold. Curtiss-Wright accept no liability for losses of any kind resulting from incorrect programming of this parameter. Chapter 3 Section 11.4.

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## 2.33 MAXIMUM CURRENT LIMIT, BOOST DRIVE CURRENT & BOOST DRIVE TIME

### **WARNING:**

The values in the table above should never be exceeded. Doing so will invalidate the warranty and affect the long term reliability of the Power Module. Chapter 3 Section 12.1.



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## 2.34 COMPENSATION

### **WARNING:**

These tests should be conducted in an open space and a restraining device such as a set belt should always be used. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The wheelchair manufacturer is responsible for ensuring that the value of Compensation is correctly set for the motors being used on the wheelchair. This is particularly important if replacement motors are being sent out to upgrade a wheelchair already in the field. Failure to comply with this requirement may result in poor control characteristics, which in extreme instances can make a wheelchair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The wheelchair manufacturer is responsible for always ensuring that any replacement motors supplied as spare parts are fully compatible with the originals that the system was programmed to match. Failure to comply with this requirement may result in poor control characteristics, which in extreme instances can make a wheelchair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

A control system must not be moved from one wheelchair type to another without first ensuring that the system is correctly programmed for the wheelchair it is intended to fit it to. Even if control systems have the same Curtiss-Wright part number, they may not be programmed the same. Failure to ensure the system is correctly programmed for the wheelchair may result in a hazardous condition. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 3 Section 12.5.

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## 2.35 JOYSTICK STATIONARY TIME & RANGE

### **WARNING:**

The values of both Joystick Stationary Time and Joystick Stationary Range have been selected by the wheelchair manufacturer in order to minimize the risk of motor damage. Do not adjust these values with consulting the wheelchair manufacturer.

Curtiss-Wright accept no liability for losses of any kind resulting from the adjustment of the Joystick Stationary Time and Joystick Stationary Range parameters. Chapter 3 Section 12.11.

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## 2.36 COMPENSATION FACTOR

### **WARNING:**

Inappropriate values of Compensation and Compensation Factor could make the wheelchair uncontrollable and potentially unsafe. Curtiss-Wright accepts no liability for losses of any kind resulting from inappropriate setting of either or both of these parameters. Chapter 3 Section 12.13.

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## 2.37 OEM FACTORY

### **WARNING:**

It is the responsibility of the vehicle manufacturer, to ensure that adequate testing of the vehicle is carried out, to ensure that the values set will maintain vehicle stability and user safety. Curtiss-Wright accepts no liability for losses of any kind resulting from this parameter being incorrectly programmed. Chapter 3 Section 15.



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## 2.38 BATTERY GAUGE

### **WARNING:**

Do not operate the control system if the battery is nearly discharged. Failure to comply with this condition may leave the user stranded in an unsafe position, such as in the middle of a road. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 4 Section 2.1.1.

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## 2.39 GETTING READY TO DRIVE

### **WARNING:**

If you push the joystick before or just after you switch the control system on, the battery gauge will ripple up and down. You must release and center the joystick to resume normal operation. If you do not release the joystick within five seconds the wheelchair will not be able to move, even if you release the joystick and push it again. The battery gauge will flash 7 LEDs at this time. You can reset this condition by switching the control system off and on again. Refer to section 3. Chapter 4 section 4.

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## 2.40 GENERAL

### **WARNING:**

The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair, for both normal use and stalled conditions. Curtiss-Wright can make general recommendations for wiring for R-net control systems, but Curtiss-Wright accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used.

The chair manufacturer is responsible for ensuring that only the mating connectors specified by Curtiss-Wright on the control systems specific data sheet are used to connect to the control system. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the chair wiring system and that the workmanship associated with the wiring system is of a good enough quality. Failure to meet this condition could result in intermittent operation, sudden stopping or veering, or even create a burn or fire hazard. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 4 section 6.

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## 2.41 INTRODUCTION

### **WARNING:**

Diagnostics should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright electronic control systems. An incorrect or badly effected repair could result in an unsafe set-up of a wheelchair. Curtiss-Wright accept no liability for losses of any kind arising from an incorrect or badly effected repair. Chapter 5 Section 1.

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## 2.42 PM MEMORY ERROR

### **WARNING:**

Programming should only be conducted by healthcare professionals with in-depth knowledge of Curtiss-Wright control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Curtiss-Wright accept no



responsibility for losses of any kind if the programming of the control system is altered from the factory preset values. Chapter 5 Section 3.17.

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## 2.43 BASIC TESTS

### **WARNING:**

These tests are a minimum recommendation only. It is the responsibility of the service person(s) to perform other tests relevant to the original trip and wheelchair type.. Refer to the wheelchair's Technical Manual for exact information of other tests. Curtiss-Wright accept no liability for losses of any kind arising from the carrying out of the described tests, or from not carrying out additional relevant tests.

These tests should be conducted in an open space and a restraining device such as a seat belt should always be used. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 5 Section 4.

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## 2.44 SERVICING OF DEFECTIVE UNITS

### **WARNING:**

Any replacement work carried out without the wheelchair manufacturer's permission will invalidate the control system's warranty.

Curtiss-Wright accept no liability for losses of any kind arising from unauthorized opening, adjustments or modifications to a any component of the R-net control system. Chapter 5 Section 5.

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## 2.45 INTRODUCTION

### **WARNING:**

The Gyro cannot be used on moving vehicles, such as buses or trains. For this reason, there should always be at least one drive profile that does not have the Gyro control enabled so that the chair is always safe and stable to drive without Gyro. Curtiss-Wright accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 7 Section 1.



## CHAPTER 12 – SPECIFICATIONS

### 1 ELECTRICAL SPECIFICATIONS

Supply Voltage:	24Vdc
Operating Voltage:	16Vdc to 35Vdc
Peak Voltage:	35Vdc
Reverse Battery Protection:	-40Vdc
PWM Frequency:	20kHz $\pm$ 0.5%
Brake Voltage:	12/24Vdc
Brake Current:	200 $\mu$ A min. 1A max.
Charger Connector:	Use only Neutrik NC3MX
Battery Charging Current:	12Arms max.
Maximum Drive Current:	
R-Net 80	80A
R-Net 90	90A
R-Net 120	120A
Indicator Outputs	42W per side
Lighting Outputs	21W per side
Brake Light Output	42W total
Actuator Current:	
- ISM	15A max at reduced speed. 12A max at full speed.
- SM	12A max.
Moisture Resistance:	Electronics to IPX4
Operating Temperature:	Non LCD Modules      Modules with LCD Screens -25°C to +50°C      -10°C to +50°C
Storage Temperature:	-40°C to +65°C      -20°C to +65°C
EMC tested on sample wheelchair:	
Susceptibility:	Tested at 30V/m to EN12184 and ANSI/ RESNA requirements
Emissions:	To EN55022 Class B
ESD:	IEC801 part 2

