





Two Axis Coordinated

## **Project Description**

In this lesson we will construct a two axis coordinated motion project. We will build from our Two Axis project and configure the system to drive real axes.

Our project will use two axes and operate on an X-Y plane using 1mm per Rev. ball screws. We will move and end point in a circle and we will construct an HMI to control the motion. In addition to a start button, the HMI will provide controls to set the diameter of the circle and the speed of the motion.



The zero position of our axes will be the center of the travel and shall also be the center of our circle. We will not use home or limit switches and we will assume the position to be X=0, Y=0 at power on time. After completing the circle motions the axes will return to the starting position.

# **Coordinated Motion**

Two or more axes acting as a group to move a tool center point (TCP) along a path in a coordinate system.

Examples are 3D printers and CNC Milling Machines and our two axis circle project.

Some typical coordinate systems:

MCS: Machine Coordinate System, origin is a fixed position relative to the machine. PCS: Product Coordinate System, can have a rotation or shift to the MCS coordinate system. ACS: Axes Coordinate System, actual position of the physical axis (after homing).

For additional information about coordinate systems, please see the document named "part4\_coordinatedmotion\_v10.pdf" that can be found in the Program Files directory where C&M is installed. For Win XP the path is "C:\Program Files\A-M-C\CandM 5 2 5\Documents\Supplementary".

For the purpose of this lesson, all the coordinate systems are identical. PCS = MCS = ACS

### **Packaged Two Axis Project**

Start C&M, close the currently open project (if any) then click File, Open project. Select the TwoAxis project and click 'OK'.



# Name the new Project and view the parts of the project

Change the project Parent directory to the projects directory. Give the project a name and click 'OK'.

Project na	ame		
SimpleCi	cle		
Project pa	arent directory		
C:\Cand	MWorking_5_2_5\P	rojects	[
New proje	ect directory:		
C:\CandM	1\Working_5_2_5\Pr	ojects\SimpleCircle	

Click the Open Edit icon, to see list of schematics in the project. *C\_M\_MAIN.sch TWO\_CAN\_AXIS\_SET\_UP.sch AXIS\_SET\_UP.sch* Close the Open Edit window for now.

The project also has a simple HMI, click the C&M HMI icon, to open the HMI. The HMI has controls to run the project, set a target position and start the move to the target position. The View Error button provides a way to view error status and the Reset button a way to reset error conditions. Close the HMI for now. Click the Project Description button, is to open the project description file. We can use this file to describe the project and provide help to the operator. Close the project file.

### Build and test New Project in Virtual Mode

Click the rebuild button, to build the project. Do not interrupt Click and Move while the build is in progress. Upon completion the message "Project is successfully built" is displayed at the bottom of the Message Window. After the build completes, click the Run All button, (the large triangle) to launch all components of the project at the same time.



Click the Power button to start the application and establish CAN communication to the virtual axes. Enter a target position into the Target Position window and click the Start button. The pointers on the virtual axes will spin to represent motion and stop when the Actual Position matches the Target Position.

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### Convert the Project to Real Axes

Close the HMI window and the two virtual axes windows. Click the Close C&M Application button, to stop the application. Click Project and Options to open the options tab box and click the Desktop options tab.

Rebuild (complete necompile)       Delete C&M generated files         Open XML property file editor       Validate all property and config XML files         Open HTML EP heb file       Open HTML EP heb file	S Window Help  Target platform : PCW  Project options - Target platform: PCW  Target platform Desktop options Debugger options Target properties Load path
My N       Options         Options       Options         Cick this menu item, select a tab and press F1 for help.         The topics in this chapter describe various project specific settings.	Autosave layout       Component selection for "Run all" menu item         Desktop menu       Mitual machine         Debugger       TwoAxes         Project viewer       C&M Application         Message window       C &M Application         Debugger       C &M Application         Debugger       C &M Application         Debugger       C &M Application         Debugger       Debugger         Debugger       Project viewer
	Build options
	Auto-generate package from project after compilation     With C&M-Min-HMI     O Without C&M-Min-HMI
Uncheck the Virtual Axes box	Auto-upload package to target after compilation
and click the 'OK' button.	Set default Apply
	OK Cancel Help

#### Click Project, Open XML property file editor.



The XML file window opens with 3 panes. The right side pane lists files automatically generated by C&M. Files in the right side pane are overwritten each time the project is rebuilt. The middle pane lists XML files manually configured for the project. We need to move three configuration files to the middle pane and edit them. To move a file, click on it and then use the < button. Move the "Ccom1.prop.xml, Ax1.prop.xml and the Ax2.prop.xml files to the middle pane.



Click the file open icon, rite to open the XML file window.

Chen XML file		
CandM CandM Projects SimpleCircle Config	Config	Generated/Config       Generated/Config
I Help Cancel	Edit Save as	Delete View

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Open the Ccom1.prop.xml with a double click. When the editor opens click on Initial Data in the left side pane. The computer used to create this lesson has PCI CAN, your selections may differ due to installed hardware.

Change the attribute values as follows:

AdaptorName	CANAda	ptorKavaser

CardId ----- PCICan #0(channel0)

Port ----- 0

Baudrate ----- 1000

SendTimeoutMessage ---- 1

Click the close file icon,



and save the changes.

D

Double click on Ax1.prop.xml to open the axis 1 property xml file, then click on Initial Values. Change the following attributes: Node Id ------ 1 Movement Type ------ Linear Pos.Tech.UnitsNumer ----- 1 Pos.Tech.UnitsDenom ---- 8000 HandwheelModeEnabled - NO

NOTE: Position Technical Units Numerator is 1mm linear travel for one revolution of the motor. Position Technical units Denominator is 8000 encoder counts per revolution of the motor. Close and save the file.

XML Editor - C:/CandM/Workin	g_5_2_5/Projects/SimpleCircle/Config/Root1.Cl	MMain1.Ud1.Ax1.prop.xml	
ile Edit			
• • • • • • • • • • • • • • • • • • •			
•	<b>B</b> ×		
ClickAndMoveFunctionBlock     InitiaData	Attribute Name	Attribute Value	
	Nodeld	1	
	MovementType	Linear	
	UnderflowPosition	·16777216	
	OverflowPosition	16777215	
	PositionTechnicalUnitNumer	1	
	PositionTechnicalUnitDenom	8000	
	MinPosition	·16777216	
	MaxPosition	16777215	
	MaxVelocity	100000	
	MaxAccel	10000	
	MaxDecel	10000	
	MaxJerk	10000	
	ParameterRefreshTime	0.05	
	TrajectoryGeneratorStepTime	0.01	
	ConfigFile	Default	
	HandwheelModeEnabled	NO	
	AXIS CO EB representing a CANopen " Axis	Node identifier. The Nodeld attribute can be a	
	Reference " data structure, Instance name AXx, Notes: - If any value of the commanded motion profile (given in Technical Unit) is out of set Min/Max limits then the active function block will produce an error output.	numerical value (integer) or " Default "text. Tr entered numerical value will be the Nodeld II is entered them the Nodeld will be the numerical at the end of the AVS_COE Test instance name AX3). If there is no numerical value then the I indeterminable, and the FB will produce an en output. For example: If Instance Name = Ax3, then Nodeld = 3	ne Default : value e (e.g. d is or
		<u> </u>	*

Double click on Ax2.prop.xml to open the axis 2 property xml file, then click on Initial Values. Change the following attributes: Node Id ----- 2 Movement Type ----- 2 Movement Type ----- Linear Pos.Tech.UnitsNumer ----- 1 Pos.Tech.UnitsDenom ---- 8000 HandwheelModeEnabled - NO Close and save the file.

NOTE: Position Technical Units Numerator is 1mm linear travel for 1 revolution of the motor. Position Technical units Denominator is 8000 encoder counts for 1 revolution of the motor.

(8000 counts / mm)

XML Editor - C:/CandM/Workin	g_5_2_5/Projects/SimpleCircle/Config/Root1.CN	1Main1.Ud1.Ax2.prop.xml
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ClickAndMoveFunctionBlock	Attribute Name	Attribute Value
	MovementType	Linear
	UnderflowPosition	-16777216
	OverflowPosition	16777215
	PositionTechnicalUnitNumer	1
	PositionTechnicalUnitDenom	8000
	MinPosition	-16777216
	MaxPosition	16777215
	MaxVelocity	100000
	MaxAccel	10000
	MaxDecel	10000
	MaxJerk	10000
	ParameterRefreshTime	0.05
	TrajectoryGeneratorStepTime	0.01
	ConfigFile	Default
	HandwheelModeEnabled	NO
	InitialData belo	Nodeld beln
	AXIS_CO EF presenting a CANopen "Axis Reference" data structure, Instance name AXx, Notes: - If any value of the commanded motion profile (given in Technical Units) is out of set Min/Max limits then the active function block will produce an error output.	Node identifier. The Nodeld attibute can be a numerical value (integer) or "Default "text. The entered numerical value will be the Nodeld II Default is entered them the Nodeld will be the numeric value at the end of the AVIS_COF TBR instance name (e.g. AV3). If there is no numerical value then the Id is indeterminable, and the FB will produce an error output. For example: If Instance Name = Ax3, then Nodeld = 3
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