

## **Purpose:**

This document is a Click&Move® tutorial for the operation of a TWO-AXIS EtherCAT MACC project.

## **Document Notation:**

This document references various buttons and tabs on the C&M desktop. Many actions may be accomplished in multiple ways. This document highlights just one way to use the tool.

### Hardware:

- You will need a Windows PC (Win-Xp, Win7, Win10) with an ethernet adaptor.
- Two ADVANCED Motion Controls' EtherCAT drives with attached motors.
- MACC02c controller. (MACC02b also works but requires additional USB-Ethernet adaptor)

#### (The MACC02 Demo kit with EtherCAT contains everything needed except a CAT5 cable for the PC)

#### NOTE ON MACC02b Ethernet Ports

The MACC02b does not include a second ethernet port. Use a USB to Ethernet adapter connected to the USB port P3 of the MACC02b as the second adapter. When connected the USB device is normally assigned to Eth1: and you can proceed with the configuration.

#### NOTE

The USB-Ethernet adapter must be connected before power on to initialize correctly. You must use an adaptor with compatible chip set, see the MACC02 data sheet.

#### Software:

- Windows XP or Win7 or Win10.
- Click&Move Version 5.4.3d and the CandM-5.4.3d-GAX\_ARM.exe compiler extension.
- The Project folder is TwoAxisEtherCatMacc.

#### NOTE ON THE DEMO BOX

The drives and MACC in the AMC DEMO BOX were tuned and configured at AMC

No additional drive or MACC configuration is required

Demo Kit MACC02 Ethernet port IP addresses were changed from the default configuration.

Eth0: on connector P2 is assigned IP address 192.168.101.50

Eth1: on connector P10 is assigned IP address 192.168.100.50

(For MACC02b The USB-Adaptor is Eth1)



## Preparing the Hardware:

\*\* If you use a Demo Box, all components have been prepared and you can skip this section \*\*

## Motor Tuning –

The EtherCAT drives need to be configured and tuned to operate with the connected motors. Use the latest version of DriveWare from *ADVANCED* Motion Controls to configure and tune the drives as needed.

## Drive Addressing –

The drive address switches must be set to 01 and 02. The actual axis assignment is determined by the position of the drive in the physical connection.

## MACC Eth0: and Eth1: IP Addresses -

For maximum performance we need to reserve Eth0: for the EtherCAT field bus. The default configuration of the MACC assigns Eth0: IP address 192.168.100.50. That is the IP address used in all the example projects and documents. To prevent confusion later in this project the MACC Eth0: and Eth1: assignments are swapped.

Please modify the Linux interfaces configuration file to assign Eth0: and Eth1: as follows:

Eth0 = 192.168.101.50 Eth1 = 192.168.100.50

## **Connecting the Field Bus:**

Connect a network cable from the MACC02c connector P2 to the first drive's input connector P3. And another cable from the first drive's output connector P4, to the second drive's input connector P3.

#### Copy the project:

Copy the C&M project into the Click and Move Projects folder.

## C:\CandM\Working\_5\_4\_3d\Projects\TwoAxisEtherCatMacc

If your installed version of Click&Move differs from the version that created the project you will need to import and build before you can open or run the project.

#### Note: The supplied project was created using C&M version 5.4.3d



## **Ethernet Adaptor Settings:**

Use the Windows Control Panel to configure the Ipv4 IP address of your adaptor to communicate with the MACC. The MACC listens on IP address 192.168.100.50 and we need an address for the PC that differs only for the last number. As an example, you can set your adaptor to 192.168.100.33. Open a command prompt and ping the MACC with the command:

## C:>ping 192.168.100.50

You get a response from the MACC shown below. If the ping fails, check the configurations and the connection between the MACC and the PC.

🕰 Command Prompt	IJ×
Ping statistics for 192.168.100.50: Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),	
C:\Users\dwoolever>ping 192.168.100.50	
Pinging 192.168.100.50 with 32 bytes of data: Reply from 192.168.100.50: bytes=32 time=1ns TTL=64 Reply from 192.168.100.50: bytes=32 time<1ns TTL=64 Reply from 192.168.100.50: bytes=32 time<1ns TTL=64 Reply from 192.168.100.50: bytes=32 time<1ns TTL=64	
Ping statistics for 192.168.100.50: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),	
Hpproximate round trip times in milli-seconds: Minimum = Oms, Maximum = 1ms, Average = Oms	-

### **Project Organization:**

When finished our project will have control code running on the MACC and HMI code running on the PC, and a third program called the GATEWAY linking the HMI to the MACC. The MACC and gateway communicate over ethernet using UDP. The gateway and the HMI communicate with a shared memory.



## **Running Multiple Programs:**

1.0

The Click&Move IDE can only run and trace one program at a time. Our project necessitates running three programs at the same time. We accomplish this by creating a packaged project that contains the HMI and gateway. We can run the package stand-alone while we use the C&M IDE to debug and trace the control logic.



## Overview of Steps to Build and Run the MACC project:

- 1 Build the Control Logic
- 2 Download Control Logic to the MACC
- 3 Create the Gateway
- 4 Build the Gateway
- 5 Package the HMI and Gateway
- 6 Run the packaged project
- 7 Run the Control Logic

### **Open the Project:**

Only one project may be open at a time. Use File and Close Project to close any open project. To open a C&M project click File and Open Project.

<b>8</b>	lick&Move [	esktop- C:\	\CandM\Working_5_4_3d\Projects\TwoAxisEtherCatMacc	. D ×
File	Project Ru	n Interface	Virtual machine Collected C&M application Tools Settings Window Help	
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The Open Project window appears.

Click the ellipse button (3 dots) and set the PARENT DIRECTORY to

## C:\CandM\Working\_5\_4\_3d\Projects.



In the dropdown window select the project TwoAxisEtherCatMacc and click OK.

pen project	×
Project name	
Project thumb view ON	
TwoAxisEtherCatMacc	
Details >>	1
Project parent directory	
C:\CandM\Working 5 4 3d\Projects	
· · · · · · · · · · · · · · · · · · ·	
Project directory:	
C:\CandM\Working 5 4 3d\Projects\TwoAxisEtherCatMacc	
OK Cancel Help	



## **Setting Target Properties:**

<b>22</b> (	lick&Mo	ve De	sktop- C:\(	CandM\Workin	ig_5_4	_3d\Proj	ects\Tw	oAxisEt	herCatM	асс		IJŇ
File	Project	Run	Interface	Virtual machine	Collect	ed C&M a	pplication	Tools	Settings	Window	w Help	
	<b>2</b>   夏	- III	, 🗀 隣	44		参 🗟	∎.⊁	📕 t	( 🕸 👌	? -	Target platform :	MAL

Open the Project Options from the Project tab on the desktop. Select the target platform tab.



#### Choose the MAL-MACC - GAX - ARM compiler.

Target platform       Desktop options       Debugger options       Target properties       Load path <ul> <li>FMU - FMU (Fuitsu ARM Cortex M3 Microcontroller Card) with MicroC/0541</li> <li>MAL - MACC [Motion Automation Controller Card] with Linux</li> <li>PCI - PC with INime</li> <li>PCW - PC with Inicrosoft Windows</li> <li>PCW 64 - PC with Microsoft Windows</li> <li>PLA - AMC programmable servo drive platform A</li> </ul>	BCB - Botland 5.5 command line compiler     GAL - APM CortexA9 compler using Linux libraries     GAU - APM CortexA9 compiler using Xeromai Braries     GAV - APM CortexA9 compiler using Xeromai Braries     GMU - Programable AMC Servicity Only of on KincoBlaze     GMU - Cold Corces Compiler (Version 4.8.0)     GMV - MinGW32 goc compiler (Version 4.8.0)     GMW - MinGW32 goc compiler (Version 4.7.2)     GWV - AMIC Good Visual C++     GMX - AMIC CortexA7 compiler prepared for INtime     GRAL - APIM CortexA7 compiler for Resplery PI 2
Please, download plugins for other supported (gray) platforms!	Apply

#### Click the Target properties tab and verify the following settings.

		, , ,	
Project options -	Target platfor	rm: MAL	×
Target platform D	esktop options	Debugger options Target properties Load path	
	Host IP addres	Is:         192         168         100         50         Current refuy         4000         ms           Example:         192.168.100.1         Current refuy         1000         ms           Fast command         8000         ms	
	Port range:	50000 - 50000 used by debugger and C&M-Min-HMI Slow command 30000 ms timeout:	
	Project Id:	Use default	
	FTP properties		
	Port:	21 Vse default	
	User name:	root	
	Password:	•••••	
		Set default Apply	
		OK Cancel Help	



## **Building the Control Logic:**

2 <mark>2</mark> C	lick&Mo	ve De	sktop- C:\(	CandM\Workin	g_5_4_	3d\Proje	cts\Tw	oAxisEt	herCatM	асс		
File	Project	Run	Interface	Virtual machine	Collecte	ed C&M ap	plication	Tools	Settings	Windov	v Help	
	<b>2</b>   夏	- 1	, 🗀 隣	44 🖞		参 🖥 🛙	<b>L</b> →	📕 t	· 🕸 '	? -	Target pla	atform : MAL

Click the LARGE pyramid button 4 to run a complete build or the smaller one to just build changes. After build completes, review the Message Window for the build results.

## Package the Project:

Create a package to download to the MACC.

Click File, and then F	Package_Collected	d_Application_From_Project.
The package process	s begins -	
	File Project Run Interface Virtual machine	Collected C&M application Tools Settings Window Help
	New FBD (schematic) Open FBD (schematic)	🕨 🖈 🗟 🖷 🕨 🏬 😰 😵 ? - 🛛 Target platform : MAL
	Import FBD (schematic)	
	View FBDs (schematics)	\TwoAxisEtherCatMacc
	New project I Open project	jects\TwoAxisEtherCatMacc
	Close project	lirectory
	Save project as	name: C:\CandM\WOF44A~1\Projects
	Delete project	PROGRA~2/A-M-C/CANDM ~4/System/MAKEFI~1'
	Import project	OAXI~2/GENERA~1/INTERM~1/COLLEC~1/
	Export FB libraries to common directory	AxisEtherCatMacc/TwoAxisEtherCatMaccPackageGAX_MA
	Package collected application for release	stem/MakeFiles/PackedApplication/CandM.Sign.xml
	Package collected application from project	Package collected application for release
	Create gateway to project	Create a Packaged application directory structure from a collected application
	Exit	created in the "Collected Application/Create" menu. This directory then may be copied to a run-time device (e.g. an industrial PC or
0	CMCopy C:/PROGRA~2/A-M-C/CANDM_~4/	control card) along with the run.bat file in its root.
0	C:/CandM/Working_5_4_3d/Projects/T	woAxisEtherCatMacc/TwoAxisEtherCatMaccPackageGAX_MA

And the package process ends -

#### What's next?

- 1. Set the IP address of the remote device and the host PC
- 2. Connect your MACC to your PC with an Ethernet cable and Power it up
- 3. Download your Packaged application to your MACC by Tools/.. menu
- 4. Start your remote application by Run/Load C&M Package and run
- 5. The Debugger and MIN-HMI is now functional
- 6. Generate a C&M-HMI interface for your PC by File/Create gateway to project menu
- See also: C&M-MC help/Download application to remote device/

Download Packaged application to a MACC

\*\*\*\*\*\*



## Down Load the Control Program to the MACC:

Click the Tools tab on the C&M Desktop and then click -

## Download\_Packaged\_Application\_to\_Remote\_Target



The download begins:

🔀 C:\Program Files (x86)\A-M-C\CandM_5_4_3d\System\Bin\ALL_PCW\CAndMDesktop.exe
CHMOD: /home/root/candm/TwofixisEtherCatMaccPackageGAX_MAL/System/Libs/ALL_MAL/1iz
DHX1SG0FaramimplDpcxxxx2implKHL.so to 755
kage GAX_MAL\System\Libs\ALL_MAL\TibAxisCoParamImuDucxxxx3ImulGAL.so -> /home/ro
ot/candm/TwoAxisEtherCatMaccPackageGAX_MAL/System/Libs/ALL_MAL/libAxisCoParamImp
LDDCxxxxx31mp1GAL.so
havisCoParamImulDucxxxx3ImulCall_sa_to_755
PUT: C:/CandM/Ŵorking_5_4_3d/Projects/TwoAxisEtherCatMacc/TwoAxisEtherCatMaccPac
kageGAX_MAL\System\Libs\ALL_MAL\1ibAxisCoParamInplDpcxxxx3ImplGAX.so -> /hone/ro
0L/Canum/IW0HXISECHEPGathaCCrackageGHA_HHL/System/Libs/HLL_HHL/ILbHXISGOFAPamImp
CHMOD: /home/root/candm/TwoAxisEtherCatMaccPackageGAX_MAL/System/Libs/ALL_MAL/li
bAxisCoParanImplDpcxxxx3ImplGAX.so to 755
PUI: C:/Candm/Working_5_4_30/Projects/IWOHX18EtherCathacc/IWOHX18EtherCathaccrac LangeGX_MQLSUsterN.Libe\ALL_MAL\1ibQvisCoParamImnlmevyvy3ImnlRQL_so_5_/home-yp
ot/candm/TwoAxisEtherCatMaccPackageGAX_MAL/System/Libs/ALL_MAL/libAxisCoParamImp
LDpcxxxx3ImplRAL.so
CHMUD: /home/root/candm/lwoAxisEtherCatMaccPackageGAX_MAL/System/Libs/ALL_MAL/11 bdvicePapwarImplDmavyuvy21em1D01_cactor 255
PUT: C:/CandM/Working_5_4_3d/Projects/TwoAxisEtherCatMacc/TwoAxisEtherCatMaccPac
kageGAX_MAL\System\Libs\ALL_MAL\libAxisCoParamImplDpcxxxxImplGAL.so -> /home/roo
t/candm/TwofkxisEtherCatMaccPackageGRX_MAL/System/Libs/ALL_MAL/libAxisCoParamImp1 DwoxyxyImplcBL.so
Dpcxxxxrmpiuni.so

The Download completes

	>
Packaged application downloaded to the target device successfu What's next?. 1. Start your remote application by Run/Load C&M Package and 2. The Debugger and MIN+IMI is now functional 3. Generate a C&M+IMI interface for your PC by File/Create gat project menu See also: C&M+MC help/Download application to remote device/ Download Packaged application to MACC or PC with Linux	lly! run eway to
	OK



## Create the Gateway Project:

On the C&M Desktop Click File and create gateway project. The gateway project is created and stored in the project folder, see below.

# NOTE: You cannot overwrite an existing Gateway. If you need to regenerate the gateway first use Windows explorer to delete the old CMGateway folder.

🗆 🌗 Projects
🖃 퉬 TwoAxisEtherCatMacc
🕀 🌗 CandM_HMI
🕀 🌗 CandM_MIN_HMI
🎛 📙 CMGateway
🕀 🌗 Config
Docs
🕀 🌗 Generated
ProiLbr

## **Open the Gateway Project:**

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First close the TwoAxisEtherCatMacc project then click File and Open Project. Use the Ellipse button in the open project window to set the parent folder –

	×
roject name	
roject thumb view ON 🛛 🔽	
CMGateway	▼
Project parent directory	Details >>
2:\CandM\Working_5_4_3d\Projects\TwoAxisEtherCatMacc	
Project directory:	
N Candid M ( Arithma, E. M. 2d) Projectel Two Avis Ether Catil and CMC -	ateway

From the dropdown selection choose the CMGateway project and click OK.

## **Build the Gateway Project:**

Click the LARGE pyramid button 🇳 to build the Gateway project. After build completes, review the Message Window for the build results.



## Create the HMI + Gateway Collected Application:



Click on the Collected C&M application tab and then on Create. Accept PCW as the selected target. (The HMI+Gateway collected app runs on PC windows)

elect target	×
Target name [PCW - PC with Microsoft Windows	
OK Cano	el

Enter a name for the collected application, for example - TwoAxisEcatMaccHmi

Click OK when ready.

Application	name					
T WORKISE C	atmaccrimi					
Application	parent directo	ry -				
C:\CandM\	Working_5_4	_3d\Collecte	dApplicatio	ons		
New applica	ation directory					
D:\CandM\	Working_5_4	_3d\Collecte	dApplicatio	ns\TwaAxisE	catMaccHmi	

The collected application window appears. We add the programs to be packaged into the left pane. We need to add the Gateway and the HMI programs to the collection.

Collected Application - TwoAxisEcatMaccHmi	
Projects	Property Files
Add project	Setup
Add virtual device	Validate all
Delete	Help (F1)
Up	
Down	
	Ā
	<u>×</u>



## Adding the Gateway:

Click the Add project button, and the Add project to Application window pops up. Click the ellipse button (3 dots) and browse for folder opens. Browse to select the C:\CandM\Working\_5\_4\_3d\Projects\TwoAxisEtherCatMacc folder

Project name		
CMG ateway()	IGW_PCW)	
Project parent	directory	
C:\CandM\W	orking_5_4_3d\Projects\TwoAxisEtherCatMacc	
Project directo	y:	
e.e., and	victing 5_4_2d\Projecte\TwoAvisEtherCatMaco\CMGatewav(MG\/_PC)	

### Adding the HMI:

Click the Add project button, and the Add project to Application window pops up. Click the ellipse button (3 dots) and the browse for folder opens. Browse to select the C:\CandM\Working\_5\_4\_3d\Projects folder.

A	dd project to Application	×
	Project name	
	HSE_3dPrinter(MGW_PCW)	•
	MACC02bTwoAxisModBusEcatDemo_4-18-18_VCandM_MIN_HMI(ALL_PCwVPC MC_FB_OperationDemo_2x_EF_MACCI02(MGW_PCw) MC_FB_OperationDemo_2x_EF_MACCI02\CandM_HMI(ALL_PCw) MC_FB_OperationDemo_2x_EF_MACCI02\CandM_MIN_HMI(ALL_PCwVPCw) TwoAxisEtherCatMaccIMOV PCW)	
	TwoAxisEtherDatMacc\CendM_HMI(ALL_PCw) TwoAxisEtherCatMacc\CendM_MIN_HMI(ALL_PCw\PCw) TwoAxisEtherCatPcM6W_PCw)	
L	TwoAxisEtherCatPc\CandM_HMI(ALL_PCW) TwoAxisEtherCatPc\CandM_MIN_HMI(ALL_PCW\PCW) TwoAxisEtherCatPc_(MGW_PCW) - must be imported! TwoAxisEtherCatPc_\CandM_MIN_HMI(1)_PCW\PCW) - must be imported!	Ţ

Select TwoAxisEtherCatMacc\CandM\_HMI(ALL\_PC) from the dropdown selection.

You will see:

R

Collected Application - xyz	
Projects Add project Add project Delete Up Down	Property Files
	A V K

Click OK, the package is created and the window closes.

🔁 C	lick&Mo	ve De	sktop- C:\(	CandM\Worki	ng_5_4_3	d\Projects	s\TwoAxisE	therCatMa	асс	<u>- 0 ×</u>
File	Project	Run	Interface	Virtual machine	Collecte	d C&M applic	ation Tools	Settings	Window	w Help
	<b>3</b>	v 🖿	y 🗀 隣	44	HTML 🕨 🤅	🌣 🗟 🖷		a 🔯 🕇	? -	Target platform : MAL

Select CMGateway(MGW\_PCW) From the dropdown selection and click OK.



## **Open the Control Logic:**

Before we can run the MACC we need to close the Gateway and re-open the Control Logic. Click File, Close project (and the Gateway Closes). Click File, Open project and the Open Project window pops up. Click the ellipse button (3 dots) and browse to select the C:\CandM\Working\_5\_4\_3d\Projects folder and click OK.

Browse for Folder	×
Select parent directory of project	
Working_5_4_3a  Working_5_4_3c  Working_5_4_3c  Working_5_4_3d  CollectedApplications  Common  PackedCollectedApplications  Projects  NoAxisEtherCatMacc  TwoAxisEtherCatPc	
OK Cancel	

Select the TwoAxisEtherCatMacc project from the dropdown list and click OK.

Dpen project	×
Project name Project thumb view ON	
TwoAxisEtherCatMacc	-
Project parent directory	Details >>
C:\CandM\Working_5_4_3d\Projects	
Project directory:	
C:\CandM\Working_5_4_3d\Projects\TwoAxisEtherCatMacc	
OK Cancel Help	



## **Starting the Application:**

We start the TwoAxisEtherCatMacc application in two steps. First start the Collected Application and second start the application downloaded to the MACC.

## Starting the Collected App:

<b>8</b>	lick&Move D	esktop- C:\	CandM\Workin	ig_5_4_3d\Projects\Two	AxisEtherCatMacc	<u>- 0 ×</u>
File	Project Run	Interface	Virtual machine	Collected C&M application	Tools Settings Windo	ow Help
	⊅ 進・■	d 🗋 🕒	4 4 🖞 🛙	🔤 🕨 🌣 🧟 📕 🕨	🎬 🖪 🕸 🤶 -	Target platform : MAL

Click the Collectd\_C&M\_application tab on the desk top and choose Run and the Open Application window pops up. From the dropdown selection choose TwoAxisEtherCatMaccHmi and click OK.

Open application	×
Application name	1
TwoAxisEtherCatMaccHmi xx xyz	
OK Cancel	

After some seconds the HMI will appear.

Event     Power     Fault       Event     Power     Fault       Source Present     Power       10     0       10     0       10     0       10     0       10     0       10     0       10     0
E-Cel         Power         Fault         ≸           2         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0
Image: Command Values         Image: Command Values           Aves         Velocity         Position         Maxeed Pasters           1         10         0         0           2         10         1000         0           Aves         1000         0         5tel           Aves         500         0         0
Command Values         Measured Publics           Axes         Velocity         Position         Measured Publics         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10         10
Command Values         Measured Position         Measured Position         <
Aces         V-elocity         Position         Measured Position         Diamond Position           1         10         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         <
1         10         0         0           2         10         1000         0           Aver-Cenert         1000         0         5/64           Jark         5000         5/00         5/00
2 10 1000 0 ● Stat Accel-Decel 1000 Jerk 5000
Accel- Decel 1000
Jerk 5000



## Starting the control logic:

<b>2</b>	🔀 Click&Move Desktop- C:\CandM\Working_5_4_3d\Projects\TwoAxisEtherCatMacc															×
File	Project	Run	Interface	Virt	tual machine	Collec	ted C&M	l applic	ation	Tools	s Settir	ngs	Windo	w He	lp	
	<b>9</b>   R	-	y 🗀 隣	4	4 🖞 🕻		参 🖣	1	►		u 🖗	?	-	Targe	t platform : M	1AL
						-	3	• *								

To start the MACC application click the run **Line** button.

If everything is working, after some seconds the Ether-Cat indicator on the HMI will turn Green. Click the Power button to enable the drives set your target positions and speeds and start a move.

## **Stopping the Application:**

You can stop the control logic for this project at any time, click the stop button. All motion will stop.

You can stop the Hmi+Gateway, just click Collected\_C&M\_Application and Close All.





## **Additional Notes About MACC Projects**

- 1 You must re-package and then download the package to the target (MACC) if you make changes to the control logic. (Else the project file and downloaded app are out of sync)
- 2 You must re-create the gateway each time you make changes to the type or number of variables shared between the control logic and the HMI.
- 3 You need to change the compiler selection to PCW before making changes to the HMI and back to the MACC compiler for everything else.