## 科尔摩根白皮书系列 —— SynqNet 控制器 QMP 开发环境搭建及编程

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## 客户应用案例:

### QMP-SYNQNET 控制卡让客户在半导体行业抢占先机

SynqNet 控制器使客户在半导体行业抢占先机,客户在研发印刷电路板自动光学检测系统,客户的要求很明确:更高的性能、更高的产量、更高的可靠性和更低的成本。设备是一款基于光学技术的精密检测工具,它采用突破性的实体形状建模技术(业界首创),以逼真的三维可视化技术对元件和焊点进行测量和识别。要求的精度和速度高达 21 平方厘米/秒(3.25 英寸/秒),以减少循环周期时间。

MEI 控制卡通过 SynqNet 数字运动网络接口,全面实现了整体的设计目标,具有极高的操作性。C/ c++库 支持多个操作系统和计算平台,因此 Agilent 可以为下一代机器选择平台和操作系统,而不需要绑定到单一 解决方案。

### QMP-SYNQNET 控制卡为造浪机设备,推波助澜

SynqNet 控制器在造浪机行业也有很好的表现,造波机包括造波板和驱动元件,由驱动元件驱动造波板产 生摆动动作,造波板的摆动带动水流产生波浪。安装时,造波板和驱动元件被固定于特定水位位置。QMP-SYNQNET 控制卡可以驱动 32 根轴,高性能而且搭配灵活。科尔摩根已经在全国拥有超过 9 个重点项目。 拥有丰富的经验。



科尔摩根 Synqnet 总线是一个高性能、全数字的开放性同步运动控制网络。它采用一种实时、同步数字网络技术及双冗余数据通道设计,从而可在各种复杂应用中实现卓越的运动性能,并确保机器运行的高可靠性。目前 Synqnet 总线控制器产品经历了 XMP、ZMP 到目前的 QMP 系列,产品性能越来越好,也为用户提供了更加成熟可靠的高性能控制方案。

本文为初次使用 QMP 控制器的用户提供安装和搭建开发环境及编程指导。内容包括硬件安装、软件安装、 环境配置、开发步骤, 方便大家快速进入 QMP 控制器开发的大家庭。

### 硬件安装:

QMP 控制器硬件有三种计算机总线形式 PCI/PCIe/CPCI, 如下所示:







QMP 64-Bit Control PCle Bus QMP 64-Bit Control PCI Bus

QMP 64-Bit Control CPCI Bus

#### 现有产品列表:

Part Number	Description
T131-0001	QMP-SynqNet-PCI-RJ-1200
T131-0002	QMP-SynqNet-PCI-RJ-800
T131-0003	QMP-SynqNet-PCI-RJ-400
T134-0001	QMP-SynqNet-GB-CPCI-3U-RJ-1200
T134-0002	QMP-SynqNet-GB-CPCI-3U-RJ-800
T134-0003	QMP-SynqNet-GB-CPCI-3U-RJ-400
T135-0001	QMP-SynqNet-GB-PCIe-RJ-1200
T135-0002	QMP-SynqNet-GB-PCIe-RJ-800
T135-0003	QMP-SynqNet-GB-PCIe-RJ-400

安装要求工控机主板有空余的对应总线插槽,并兼容IL认证标准。

安装步骤:

- 1. IPC 关机断电,并拔掉电源插头
- 2. 注意静电保护, 安装 QMP 控制卡不能用手接触金手指部分, 有条件的带好静电保护装置
- 3. 插好控制卡,并用螺丝固定,防止松动或接触不良

安装后示例如下:





4. 控制总线接口是标准的 RJ45 接口,可以支持标准的以太网线,建议五类线以上网线

## 软件安装:

使用 QMP 控制卡,需要软件配合。目前 QMP 控制卡需要 MPI04.02 以上的版本才能支持安装,新的 Lite 版控制卡(T13x-0003)需要 MPI04.04.12 以后的版本才能支持安装。

使用 QMP 开发项目需要的软件和系统要求如下:

- 1. Win7 及以上 OS 环境, 支持 32 位或者 64 位系统, 安装对应版本的 32 位 MPI 或者 64 位 MPI。
- 以 64 位 OS 安装 64 位 MPI 04.04.12 为例。双击安装文件 SW-MPI 0201\_04.04.12\_Win64Setup.exe。显示如下:

InstallSh	ield Wizard			
Motion Engineering's MPI Motion Developers Kit Setup is preparing the InstallShield Wizard, which will guide you through the program setup process. Please wait.				
Decompressing: Motion Engineering's MPI Motion Developers Kit.msi				
		Cancel		







🖟 Motion Engir	eering's MPI Motion De	evelopers Kit - 04.	04.12	$\times$
Destination Fo	older nstall to this folder, or click	Change to install	to a different folde	r.
C:V	all Motion Engineering's M Program Files\MEI\MDK\04	PI Motion Develope .04.12\	ers Kit to:	Change
InstallShield ——				
		< Back	Next >	Cancel
🔀 Motion Engin	eering's MPI Motion De	velopers Kit - 04.	04.12	$\times$
Setup Type Choose the se	tup type that best suits y	our needs.		MOK
Please select a	a setup type. Ar Seat - Complete Ins Installs development too support application deve Installation Installs only the necessa applications. Does not ir Files or Sample Apps. Th development seat. Choose which program for will be installed. Recomm	tallation ls, utilities, sample lopment. (Require ny files to support install development his installation shou eatures you want i ended for advance	apps and libraries i s the most disk spa run-time systems a tools such as Head ld NOT be used for nstalled and where ed users.	to ace.) Ind ler a
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Click Install to begin the installation.         If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.                 Create Desktop Shortcut           InstallShield                 Cancel          Motion Engineering's MPI Motion Developers Kit - 04.04.12              Installightotion Engineering's MPI Motion Developers Kit            Installing Motion Developers Kit. This may take several minutes.           Status:             Copying new files           InstallShield	The wiza	izard is ready to begin installation.	MUS
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InstallShield			
	InstailShield -	< Back Next > Cancel	





至此 MPI 安装完成,重启后生效。

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缺省安装目录如下: C:\Program Files\MEI\MDK\04.04.12

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> This PC > SYSTEM & DATA (C:) > Program Files > MEI > MDK > 04.04.12							
	Na	me	Da	te modified	Туре	Size	
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	C POF	Release Notes.pdf	12,	/4/2009 12:47 PM	Foxit PhantomPD	21 KB	

其中 Win32 录下包括调试程序 MotionConsole 和 MotionScope 及 meiConfigGui, Win64 目录下包括实用 程序 Version、Vm3、Server、MeiReset、Message 等,具体作用请见 MPI 培训文档。



- 3. VS2010 以上版本的 IDE, 安装 VS2010 以上版本的 IDE, 科尔摩根不提供此软件。
- 4. CTK (按需选装) 安装过程跟 MPI 类似,该安装包包括 BodeTool 工具,用于频域分析和调试。
- 5. Mechaware(按需选装)安装过程跟 MPI 类似,该安装包包括 Matlab/Simulink 插件,用于自定义控制 算法编写。

#### 环境配置:

1. Synqnet 控制器支持三种网络拓扑:串行、双串行和环形,可以根据需要选择相应的连接形式。



2. 驱动器连接完成后,在系统 CMD 窗口输入 Version 可以查看系统硬件和网络状态,如下所示:



画 管理员: C:\Windows\system32\cm	nd.exe
Microsoft Windows [版本 6.1	.7601]
版权所有 <c> 2009 Microsoft</c>	Corporation。保留所有权利。
C:\Users\Kollmorgen>version	
MPI: version 04.03.16 revis	ion id 67281
MPI firmware: version 916 o	ption Ø
QMP firmware: version 916 r	evision A sub-revision 2
option 20 b	ranchId Ø
Driver: version 3.311.1	
OMP Bootd Hersion 2 018	
QMP Debugger Version 2.020	
PLD : version 0x0000 opti	on 0×0000
Rincon: version 0x0324 pack	age 0xA901
QMP : T131-0001 Serial N	lumber 214160004
Configuration File Version:	R1A
MSI Interrupts: Disabled	
Synqnet State : SYNQ	
Topology Saved: NO	
Synqnet: 1 Nodes, String	
In port : Ø nodes	
Out port : 1 nodes	
Node[0] - Kollmorgen AKD-SG	2
Node Type : 0xDA00A000	FPGA ID : 0×DA000003
Option # : 0×00000000	FPGA Ver : 0x04020502
Serial # : NA	FPGA Branch : 0x00000300
Model # : NA	FPGA Type : RUNTIME
Unique # : 0x530E00D3	FPGA Default: YES
Switch # : 0×00000010	
ID Match : YES	
Drive[0] Firmware version	: M_01-15-00-000
Operating system	
сви	
Intel64 Familu 15 Model 4	Stenning 3
Intel(R) Pentium(R) 4 CPH 3	- MAGHz SSE Summort
Clock = 2992 MHz	
License	
Axis Count: 64	
Feature: SyngNet Mas	ter
Feature: Motion	
Feature: MechaWare	

网络状态是 SYNQ, 说明系统状态没有问题, 正常工作。同时可以看到网络上的节点数量、类型、固件等 信息以及控制卡 License 的情况。

3. AKD 系列驱动器固件包含 FPGA 文件,不用单独下载,如果是 S200、S300 或者 S700 等老驱动器需 要单独下载 FPGA 文件,根据提示下载即可。MPI 安装包内包含了下载所需的 FPGA 文件。



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 $^{\textrm{>C}}$   $\rightarrow~$  SYSTEM & DATA (C:)  $\rightarrow~$  Program Files  $\rightarrow~$  MEI  $\rightarrow~$  MDK  $\rightarrow~$  04.04.12  $\rightarrow~$  node

C0FE002C_0501.sff	COFE002D_0501.sff	C0FE002E_0501.sff
C0FE002F_0501.sff	COFE003A_0501.sff	C0FE003B_0501.sff
C0FE003D_0501.sff	C0FE003E_0501.sff	COFE003F_0501.sff
C0FE004A_0503_00_03.sff	C0FE004C_0501_00_08.sff	C0FE004D_0503_00_06.sff
C0FE0018_0501.sff	C0FE0019_0501.sff	C0FE0021_0501.sff
C0FE0024_0501.sff	C0FE0026_0501.sff	C0FE0027_0501.sff
C0FE0029_0501.sff	C0FE0030_0501.sff	C0FE0031_0501.sff
C0FE0032_0501.sff	C0FE0033_0501.sff	C0FE0034_0501.sff
C0FE0035_0501.sff	C0FE0036_0501_00_01.sff	C0FE0037_0501.sff
C0FE0038_0501.sff	C0FE0040_0501.sff	C0FE0042_0501.sff
C0FE0043_0501.sff	C0FE0044_0501.sff	C0FE0045_0501.sff
C0FE0046_0501.sff	C0FE0047_0501.sff	C0FE0048_0501_00_07.sff
C0FE0049_0501_00_03.sff	Convex_CSDM4-SQ.dm	Convex_CSDS1-SQ.dm
Glentek_Omega.dm	📄 Kollmorgen_AKD.dm	Kollmorgen_CD.dm
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Kollmorgen_ember_281x.a00	Kollmorgen_LAM.dm	Kollmorgen_LAMV2.dm
Kollmorgen_MSM4.dm	Kollmorgen_PicoDAD.dm	Kollmorgen_S200.dm
📄 Kollmorgen_S300.dm	Kollmorgen_S600.dm	Kollmorgen_S700.dm
Kollmorgen_S1800.dm	Kollmorgen_SqDC.dm	Kollmorgen_SqStep.dm
SanyoDenki_Q-series.dm	SanyoDenki_R-series.dm	Yaskawa_SGDS.dm
Yaskawa_SGDZ.dm	Yaskawa_SGDZ-BS-80.dm	

4. 至此可以进行 PID 参数设定,具体调试过程内容较多,请参见相关培训文档。

## 开发步骤:

系统配置完成后可以进行应用程序开发。目前 MPI 支持 C、C++和 MFC 应用程序开发。

 安装应用程序向导:按照 MPI 安装文件夹 C:\Program Files\MEI\MDK\04.04.12\AppWizard\Win64\VS2010 里 readme.txt 说明安装应用程序向导。



HIE Edit Format View Help To install the MPI64 App Wizard for Microsoft Visual Studio 2010:

1) Copy MPI64 App Wizard.vsz and MPI64 App Wizard.ico into the Visual C++ project template search path for your Visual Studio installation. The default location is C:\Program Files\Microsoft Visual Studio 10\VC\VCprojects.

2) Copy the entire MPI64 App Wizard subdirectory to the VCWizards directory of your Visual Studio installation. The default location is C:\Program Files\Microsoft Visual Studio 10\VC\VCWizards.

3) The MPI64 App Wizard will now appear in the Visual C++ panel of the New Project window in Visual Studio.

#### 2. 生成新的应用程序:打开 VS2010,点击菜单创建新的项目。

File Edit View Debug Te	am Data Tools Test	Window Help	
New	•	Project	Ctrl+Shift+N
Open	•	Team Project	
Close		👌 File	Ctrl+N
Close Solution		Project From Existing	Code
Save Selected Items	Ctrl+S	- HE-MAN	
Save Selected Items As		Visual 9	tudio 2010 Profession
Save All	Ctrl+Shift+S	. Tibudi c	2010 1101035101
Export Template			
Export Template Source Control	•	t Connect To Tour	Get St
Export Template Source Control Page Setup	•	Connect To Team	Foundation Server
Export Template Source Control Page Setup Print	• Ctrl+P	Connect To Team	Foundation Server RSS f
Export Template Source Control Page Setup Print Recent Files	Ctrl+P	Connect To Team	Foundation Server RSS f
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Export Template Source Control Page Setup Print Recent Files Recent Projects and Solution	Ctrl+P	Connect To Team	Foundation Server



New Project			?
Recent Templates		ET Framework 4  V Sort by: Default  V III III Search Installed Templat	es
Installed Templates		Type: Visual C++	
▲ Visual C++	^	CLR Console Application Visual C++	
ATL CLR		CLR Empty Project Visual C++	
General MFC		Class Library Visual C++	
Test Win32		Custom Wizard Visual C++	
<ul> <li>Other Languages</li> <li>Visual Basic</li> <li>Visual C#</li> </ul>		Makefile Project Visual C++	
Windows Web		MFC ActiveX Control Visual C++	
Reporting Test		Test Project Visual C++	
WCF Workflow		Windows Forms Control Library Visual C++	
<ul> <li>Other Project Type</li> <li>Database</li> </ul>	es 🗸	MPI App Wizard Visual C++	
Online Templates		~	
Name:	MPI App Wizard3		
Location:	C:\MyDir\WorkP	am\VS2010_Prog\TestProgram\   Browse	
Solution name:	MPI App Wizard3	✓ Create directory for soli Add to source control	ution

## 确定后弹出应用程序向导界面

MPI App Wizard - MPI App Wizard	13	?	$\times$
Welcome	to 'MPI App Wizard'		
Page 1 Page 2 Page 3	Application Type: ● ⊆ App O C±+ App O MFC App Comment Options: ✓ Include source code comments ✓ Include MEI Copyright		
	< Previous Next > Finish	Cance	el 🔤



可以选择 C App,	C++ App 或者 MFC App,	以 MFC App 为例,	下一步选择需要控制的	对象和数量。

MPI App Wizard - MPI App Wizard3					×
Welcome	to 'MPI App Wizard'				
Page 1	MPI Objects to Include	$\sim$			
Page 2 Page 3	Use Objects	Object Count	Use Objects	Object Cour	nt
i dge o	Motion Supervisors		Recorders	1 🗸	
	Axes	5	SynqNet		
	✓ Filters	7 8 9	SqNode Objects	1 🗸	
	✓ Motors	10 11 12	Notify Objects	1 🗸	
	Captures	13 14	Мар		
		15 16 17 18 19	Sequence Objects		
	Command Line Parsing:	20 21 he 22	<ul> <li>Basic</li> </ul>	Advanced	
	< Pre	23 24 25 Ne 26	ext >Einish	<u>C</u> ancel	
勾选 MEI Sample Applicatio	n,点击"Finish"				
MPI App Wizard - MPI App Wizard3 ? 🗙					$\times$
Welcome	to 'MPI App Wizard'				
Pros 1	Poot MEI Directory				

Page 1	Root MEI Directory:
Page 2 Page 3	Use MEI_MDK_DIR environment variable     Other:
	MELSample Application
	< Previous Next > Einish Cancel



再下一步,

应用程序向导会根据选择的条件,生成一个新的 MPI 应用程序框架,基本代码自动生成,并且环境变量配置完成。接下来只需要在框架里修改界面,填写需要的功能即可。



### 网络资源:

相关资源可以从以下网页中找到:

- 1. <u>http://support.motioneng.com</u>
- 2. <u>https://www.kollmorgen.com/en-us/products/machine-controls/automation-platform/synqnet/synqnet-overview</u>

