

Application Bulletin

August 8, 2007

OCS Communication with Emerson Epsilon Drive

Using OCS Modbus Ethernet TCP to communicate with Emerson Control Techniques Epsilon EP drive.

Overview

This document describes how the OCS, the Drive and the PC are connected together to make a motor Rotate. This is intended to describe where I got the information, how I got it, and why I chose the values to make this drive function, some of this is step by step and some of it assumes the reader knows a little something with Cscape. Where there is lack of Information or something doesn't quite jive, I can be reached at (317) 492-9117, John Shuttz

Setting up the Hardware

Equipment

1. In this case I'm using a QX451 BP43 as the Master TCP.

2. I'm using a PC with a secondary Ethernet card set up as a static IP, this keeps me from tripping up the companies daily business..

- 3. Ethernet Hub instead of a switch. Ethereal doesn't trap everything using switches.
- 4. Emerson Epsilon EP Drive.

5. Control Techniques Power Pro tools software to configure the drive for a motor, downloadable from the website.

- 6. Cscape software to program the OCS451 and Ethernet. Also downloadable from the web site.
- 7. Ethereal software for analyzing the network. Again downloadable.
- 8. HE500CBL300 programming cable.
- 9. Three foot Cat5 cable, straight through, X 3 (for PC, Controller, and drive)
- 10. Three foot Cat5 cable, crossing, When connecting the PC direct to QX for use with out the Hub

11. Motor TBD

Software

Software locations; all are Shareware, except Modbus Poll and slave.

1. Power Pro tools FM 4.2 was downloaded here, it supports Epsilon series drives.

http://www.controltechniques.com/downloads/software/software_frame.htm?software_ctsoft.asp&mainFrame 2. Ethereal, I downloaded for windows; Google will find this as well.

http://www.ethereal.com/download.html

3. Cscape

http://www.heapg.com/Pages/TechSupport/CscapeSoftware.html

4. Modbus Poll and Slave; handy tools for simulation, I had to use them to help me figure some things out. This is a full download and will ask you to register every time you connect, and will disconnect after 5min of uses,

simply reconnect. To avoid all this, just register with a purchase.

http://www.modbustools.com/download.asp

1. <u>Determining the IP address of the drive</u>, I chose to start here because I needed to get initial communication with it, I decided to keep its address and adjust my controller and PC to accommodate.

a. Install and open Power Tools Pro

b. Click File new

c. Expand epsilon EP from the list

d. Then select EP-P setup (I have a EP204-P00-EN00) and press OK



e. Click on Device



f. Then Change path.

g. This searched the Ethernet to find devices IP address, now I can set up the PCs IP address, and the controls because I need the upper 3 octets the same value. 192.168.1.42. is the Drives ID.

Change Path							×
IP Address Scan Range Start 192 168 1 42 End 1 1 42							OK Stop Scan Cancel
IP Address / COM ID Drive	Module	Options	Base	Modul	Module Ser	Drive S	
I 192.168.1.42 1 EP204-P			Α1	Α1	0632E024	0632E	
Found a device at IP 192,108,1.42 Found 204-on 192,108,1.42 at Modbus 1 Soanning Comm 1 for device 1 Scanning Comm 2 for device 1 Unable to open Serial Comm port 7 at Baud rate 1920	10						PC lp Config <u>H</u> elp

- 2.
- Setting up Ethernet port on PC Now that I know my device IP is 192.168.1.42, I'll use PC ID 192.168.001.001 From the control panel I selected Network connections a.
- b.

c. I have 2 LAN cards, connection 2, a 3com device has my static IP address, connection 1, a NETGEAR device has a server assigned IP and I don't want to booger that up.
d. I Clicked on connection 2 to edit its IP.

Setwork Connections		
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorite <mark>s <u>T</u>ools</mark>	Adva <u>n</u> ced <u>H</u> elp	
🚱 Back 🝷 🕥 🗧 🏂 🔎 S	iearch 😥 Folders 🛄 🕶	
Address 🔇 Network Connections		💌 🄁 Go
	Name	Type Sta Device Name
Network Tasks 🔅	LAN or High-Speed Inter	rnet
Create a new connection Change Windows Firewall settings	Local Area Connection	LAN Con NETGEAR FA312 LAN Con 3Com EtherLink XL
N	· (<)	>
2 objects		

Select properties e.

📥 Local Area C	onnection 2 Status	? 🛛
General Suppor	t	
Connection-		
Status:		Connected
Duration:	11	days 19:10:21
Speed:		10.0 Mbps
Activity		
	Sent — 🔊 📍 –	- Received
Bytes:	633,476,931	588,856,665
Properties	<u>D</u> isable	

- Scroll down to expose and select Internet Protocol (TCP/IP) Then click properties f.
- g.

🕹 Local Area Connection 2 Properties 🛛 🔹 💽
General Authentication Advanced
Connect using:
3Com EtherLink XL 10/100 PCI For C <u>Configure</u>
This connection uses the following items:
QoS Packet Scheduler
Internet Protocol (TCP/IP)
Install Uninstall Properties
Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
Show icon in notification area when connected Notify me when this connection has limited or no connectivity
OK Cancel

h. I assigned the PC an ID Of 192.168.001.001 because my drive was 192.168.001.042. I wanted to keep it simple at first by just getting communications rolling. First 3 octets are the same value as the others

Internet Protocol (TCP/IP) Proper	rties 🛛 🕐 🔀
General	
You can get IP settings assigned autom this capability. Otherwise, you need to a the appropriate IP settings.	natically if your network supports ask your network administrator for
 <u>O</u>btain an IP address automatically 	,
• Use the following IP address:	
IP address:	192.168.1.1
S <u>u</u> bnet mask:	255 . 255 . 255 . 0
Default gateway:	· · ·
O Obtain DNS server address autom	atically
Ouse the following DNS server addresses	resses:
Preferred DNS server:	
Alternate DNS server:	· · ·
	Ad <u>v</u> anced
	OK Cancel

- 3. <u>Setting up the drive</u>
- a. To get the Power Tools pro configured, establish a Path as described above,

b. When you see the address for this drive, click OK to trap the path, you should no longer see "change Path" in the status bar of Power Tools. Now it says 192.168.1.42 #1. if you do not see the address to select, the PC is not communicating with the Drive, check the wire path.

- c. Now go to device and click "reconnect".
- d. Go to device and click upload NVM.



4. <u>Set up serial communications to configure the OCS Ethernet Using Cscape Software</u>. This is required to setup the Ethernet card if your planning to program the QX via Ethernet, keep in mind the data watch and debug and downloads will tax the network, time outs need to be considered when doing this. I stuck with serial as I wanted to see the network operate, as close to real time as Cscape will not be a common drop on the Ethernet network.

a. Install the latest Cscape, in my case 8.11.0B.

b. Select Tool options, serial port

Cscape - [Upload_3]	
Elle Edit Program Controller Debug Iools Screens View Window Help	Ξ×
Image: Image	
A B C D E F G H I J K L M N O P Q I	R
1	<u> </u>
2	
	>
Ready User: NONE XLE - Cscan (Model ?) Unknown Local:??? Target:3(?) [no forces] [M	

c. My USB serial adapter is using com7, I'm using our USB600 as I know it works (a lot of them don't).

Program Options			
Editor Options Communications Port	Ladder	Download Ladder Numbering	Colors
Communications Port Comm Ports CGM500 ESD Card K Can Ethernet COM1: COM2: COM3: COM4: COM5: COM6: COM7: COM8: COM9: \\.\COM10 \\.\COM11	Ladder Maxim 11520 Jimeo 3000	Ladder Numbering um serial baud rate: DO ut: mS	Colors
ОК	Cancel	Apply	Help

d. Local ID matches the target ID, I'm Using one of the CBL300s plugged in to my adapter on one end and the other to the QXs MJ1 Serial programming port

C	Csca	ape -	[ModT	CPem	erson	.cs)]																											×
ψţ	Eile	<u>E</u> dit	Progra	am <u>⊂</u> or	ntroller	De	ebug j	<u>T</u> ools	<u>S</u> cr	reens	⊻j	ew	<u>W</u> indo	wĿ	<u>l</u> elp																		- 6	×
	<u> </u>	3 -	136	3 3	B	ß	₽ ↓	<u>et</u>				Ø	4	0 ¥	ķ	\ ?						Bo	olea	n Elem	ents	•	•							
JE		/F +()) -(>) -(P)- (N)-	-(s)- (R)-																												
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16		1																																^
9																																		
1		<																															>	
T	Rea	ady											User:	NON	E		HE	QX5	51 BP	43 (M	lodel =)		Unkn	own	Local	:253	Targ	et:25	3(R)	[no fo	rces]	MOD	

- 5. <u>Setting up the QX Ethernet port and to ditch the Serial communication</u>
- a. In Cscape select Controller | I/O configure |
- b. Click on the Config button to the right of the Ethernet module
- c. Click on the tab "module setup" to get to this screen
- d. Since my drive was 192.168.1.42, and my PC is 192.168.1.1, this controller will be 192.168.1.20

e. I've chosen R2000, R2002, and 2003 for registers, I need to assign them even if I'm not using them in ladder at this point.

f. Notice I don't check the Modbus tcp slave, this device will be the master and will be configured for it elsewhere. ICMP is already checked and its always a good idea, otherwise nothing is required to be checked here.

Mod	lule Configuration	n					×
170) Map Module Setup]					
	Register Usage						
		Default Settings	Register		Direction		
	IP Address:	192.168.1.20	R2000	32-BIT	Read Only 💌	Use CAN ID for last Octet	
	Net Mask:	255 . 255 . 255 . 0		32-BIT	<u></u>	Enhanced Configuration	
	Gateway:	0.0.0.0		32-BIT	_	Enhanced Conliguration	
	Status:		R2002	16-BIT	Read Only		
	Version:		R2003	16-BIT	Read Only		
	- Protocol Support						
		 ✓ ICMP (Ping) ■ EGD (Ethernet Global D ■ SRTP Slave (90-30 Set ■ Modbus TCP Slave ■ Ethernet/IP ■ Ethernet/IP ■ FTP (File Server) ■ HTTP (Web Server))ata) rvice Request)			Configure Selected Protocol	
					OK	Cancel Apply	

6. Determining what I want to read from the drive so I can setup my network master.

a. After uploading the drive parameters described above, I can then see what address I can read from this drive.

- b. In the far left pane expand Axis 1 if not done so already, then Network, and select Modbus RTU/TCP.
- c. In the center pane expand status, and select and drag and drop FreeRunTime in the right pane.
- d. Now go to Device | Download.

e. Notice that this software suggests 30,003 in my case this could be different depending on many things, the focus here is how I got my information.

f. 30,003 is the Modbus address I want to read from this device. I chose this because I want Dynamic data that I can watch. Also this will help me justify the values I'm seeing in the power tools watch window and Cscape data watch



- 7. <u>Configure the tcp/ip network</u>
- a. In Cscape select Program Protocol Config
- b. In the Ethernet drop down select Modbus TCP/IP
- c. Then click network

Protocol Config						×
Serial Protocols						
MJ1	None	•	Network	Devices	Scan List	
MJ2	None	•	Network	Devices	Scan List	
CN1	None	•	Network	Devices	Scan List	
Ethernet						
	Modbus Top/Ip Client v 1.02	•	Network	Devices	Scan List	
			01	K Can	cel	

- d. I've set the Status Register up for R100
- e. This is 4x 32 bit register, R100/101, R102/103, R104/105, R106/r107

f. Update Interval is chosen based on network traffic, and how often I really need the data from this device, keep in mind there will be other things communicated on this network, not just 1 Emerson. This device will pull as fast as allowed, this values sets how long your willing to wait for a "retry".

g. Reacquire time is the amount of time to wait before jump starting the network after the number of "retry" has been exceeded, used to allow the slave and master to get itself together after many collisions. If the plug is pulled for (Update*retry)+1update, R200 is updated with –204=timeout, the R100 will have 2 because update has been exceeded 2 times

h. Timeout is the amount of time between "retry". Keep this realistic if it takes more than 1 sec to get a response, something is locked up.

i. Retry is how many times to send a command again when the "update interval" has been exceeded. This will contribute to network traffic. If hardwired, I keep 1 in here. If on wireless, 2 or 3 is a good Idea.

j. Keep alive time is how often a heart beat is sent to a slave to keep communications when no reading or writing is being done. This is determined by how long can a slave handle being ignored, most could care less otherwise this is a test to find value.

Network Config (Modbus Tcp/lp Clie	ent) 🔀
Port Configuration Minimum Port Id 1024 Maximum Port Id 768	Update Scan Automatic Update Interval: 600 mSec ReacquireTime: 100 mSec
Keep Alive Time 60000	C Manual
	Trigger: •••••• ID Select: •••••
	Status Register: %R0100 4 x 92-617 Name: Retrys
Retries: 2 (0-255) Timeout: 1000 mSec	Master ID / Address Address:
Protocol Help	OK Cancel

k. Power Pro software suggested earlier that this device is ID 192.168.001.042. I named my device and gave it that IP

- I've enabled the status and assigned R200 Ι.
- This will have R200 as a 16 bit integer and R201 as 16 bit integer m.
- I expect the R200 to stay 0 during good communications, and -204 n.
- If I disconnect the cable. I expect R200 to go to –204 after 600mS+(600mS x 2Retries) It will jump start –204 back to 0 in 100mS as per the Reacquire time. 0.
- р.

Device Config	×
Device Name: EmersonDrive IP Address: 192 . 168 . 1 . 42 Port 502	
Device Options Swap Words on 32-bit data Target returns 32-bits on single register request Device Type: Modicon PLC 5-Digit Addressing	
Status Enable Address: %R0200 2 x 16-BIT	
C Stop on Error C Retry on Error	
OK Cancel	

- q. In the data mapping I've added a target, it was selectable since I've declared it from above.
- r. I've selected address 30002 input register
- s. This is 30003(FreeRunTime)-1 modbus offset=30002(device Register as viewed from the master)
- t. Power tools software suggests this is a 32bit register so I selected a length of 2.

u. I've chosen R8 to display the FreeRunTime value from the device. Keep in mind because I'm bringing back a 32bit value, R8 and R9 will hold this value as a Dint.

v. For now I'm just reading the drive so I select Polled read command

Da	ata Mapping				×
	Target Device Name:	EmersonD	rive (192.16	8.1.42)	_
	Device Register:	30002	>	🔲 32-bit acces	s
	Length:	2			
	Local				
	Register:	%R0008			
	Name:				•
	Update Type				
	Polled Read		C Trigger	ed Read	
	C Polled Read	Write	C Trigger	ed Write	
	C Polled Read.	/Write Init	Trigg	er Register:	
				OK	Cancel

- w.
- х.
- In the Screen editor I've displayed R8 as 32bit Dint De-select editable and reselect editable to change the max and min values. I added 6 decimials to make the screen jive with Power tools watch window. у.

Numeric Data Properties 🛛 🛛 🔀				
Controller Register Address: Register Width 32-bit				
Name: RunTime42				
Data Format Font: Justification Font: Left Center Right Digits: Decimal Pos. Format 10 6 Signed Decimal Zero Filled Min: -2147483648 Editable 3D Sunken Max: 2147483647 Scaling >>> Engineering Units: Engineering Units:				
Attributes >>> Background Color >>>				
Legend >>> Line Color >>>				
Data Color >>>				
OK Cancel				

z. In the screens I'm displaying R200 the status for the device, this should be 0 if all is well and the LEDs are flashing with data.

Numeric Data Properties 🛛 🛛 🔀				
Controller Register Address: Register Width 16-bit				
Name: Statemerson42				
Data Format Justification Font:				
Digits: Decimal Pos. Format 5 + 0 + Signed Decimal				
□ Zero Filled Min: -32768 ☑ Editable □ 3D Sunken Max: 32767				
Scaling >>> Engineering Units: >>>>				
Display Properties				
Attributes >>> Background Color >>>				
Legend >>> Line Color >>>				
Data Color >>>				
OK Cancel				

aa. I'm displaying R100 as 32bit dint to show me quality of connection, a 0 tells me all is perfect, any number suggest something took too long to get through and this counts how many times it took too long.

Numeric Data Properties	×			
Controller Register Address: SR0100				
Name: Retrys				
Data Format Justification Font:				
Digits: Decimal Pos. Format				
□ Zero Filled Min: 0 ☑ Editable □ 3D Sunken Max: 4294967295				
Display Properties				
Attributes >>> Background Color >>>				
Legend >>> Line Color >>>				
Data Color >>>				
OK Cancel				

bb. Also displaying R106 as 32bit dint, this is telling me the number of good transactions.

Numeric Data Properties			
Controller Register Address: Register Width 32-bit			
Name: GoodTrans			
Data Format Justification Font: C Left Center C Right 5x7 Font			
10 ÷ 0 ÷ Decimal			
Zero Filled Min: 0 ✓ Editable 3D Sunken Max: 4294967295 Scaling >>> Engineering Units: >			
Display Properties			
Attributes >>> Background Color >>>			
Legend >>> Line Color >>>			
Data Color >>>			
OK Cance	el 🛛		

cc. Cscape Data watch I have

🔍 Watch - ModTCPemerson.csp(253)				
File				
Memory	Value	Туре	Name	
%R0200	0	INT	Statemerson42	
%R0006	0	INT	BusVoltage	
%R0007	117	INT	SegmentDisplay	
%R0008	1241557955	DINT	RunTime42	
%R0010	5227	DINT	TotalTime	
%R0100	0	DINT	Retrys	
%R0104	0	DINT	CorruptData	
%R0106	108	DINT	GoodTrans	
%R0012	200	DINT	JogVelocity	
%T0021	OFF	BOOL	JogUp	
%T0022	OFF	BOOL	JogDown	
·	1			
Print Add Bunning				

- 8. <u>To see things working</u>,
- a. Power Tools
 - i. Go to device | data watch
 - ii. In the left pane, expand Status
 - iii. Drag and drop FreeRunTime into the right pane
 - iv. In the left pane, expand Jog, then Jog.0
 - v. Drag and Drop #.Vel into the right pane

- W	atch Window
Axis Name	Axis 1
Axis Address	1
BusVoltage SegmentDisplay TotalPowerUpTime FreeRunTime Jog.0.Vel Jog.MinusActivate Jog.PlusActivate	0.0 volts 117 522.7 hrs 1246.058427 seconds 200 revs/m False False

b. Cscape

- i. I'm comparing R8 with this window.
- ii. R200 is 0, things are good
- iii. R100 thru r104 are 0 showing no issues
- iv. R106 has values showing the number of good transaction.
- v. R8 Not apparent here, is incrementing, Its 1241 is off from 1246 in the Power tools, the difference is the time it took me to print the screens and past them in this document.
- vi. R12 will update as expected as well as T21 and T22

Summary

Horner APG wrote this document on August 8, 2007. Questions or comments can be directed to the Tech Support Department by phone at 317-916-4274 or email <u>techsppt@heapg.com</u>.