



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 Shultz

Setting up the Hardware

Equipment

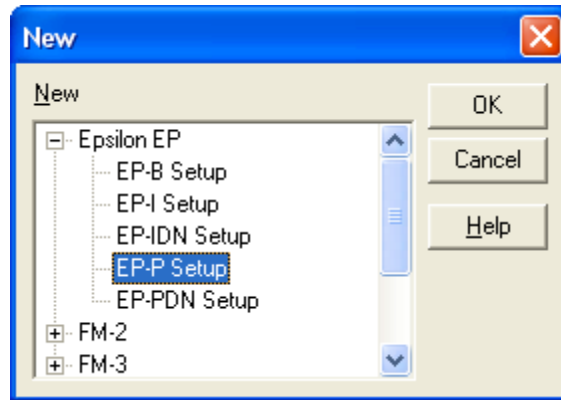
1. In this case I'm using a QX451 BP43 as the Master TCP.
2. I'm using a PC with a secondary Ethernet card set up as a static IP, this keeps me from tripping up the companies daily business..
3. Ethernet Hub instead of a switch. Ethereal doesn't trap everything using switches.
4. Emerson Epsilon EP Drive.
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

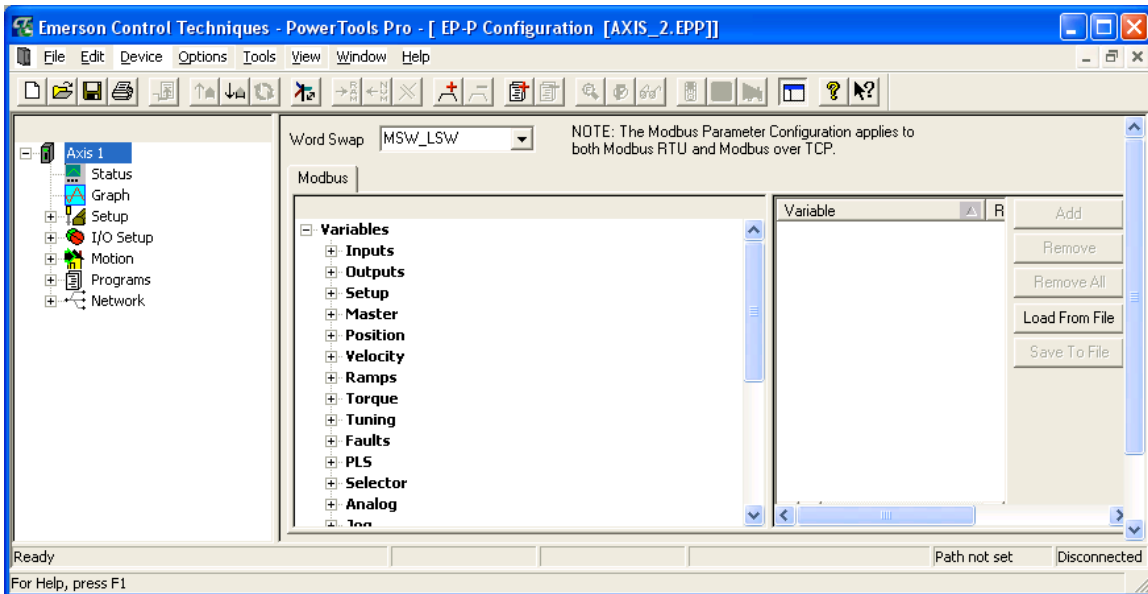
Software locations; all are Shareware, except Modbus Poll and slave.

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. Determining the IP address of the drive, 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

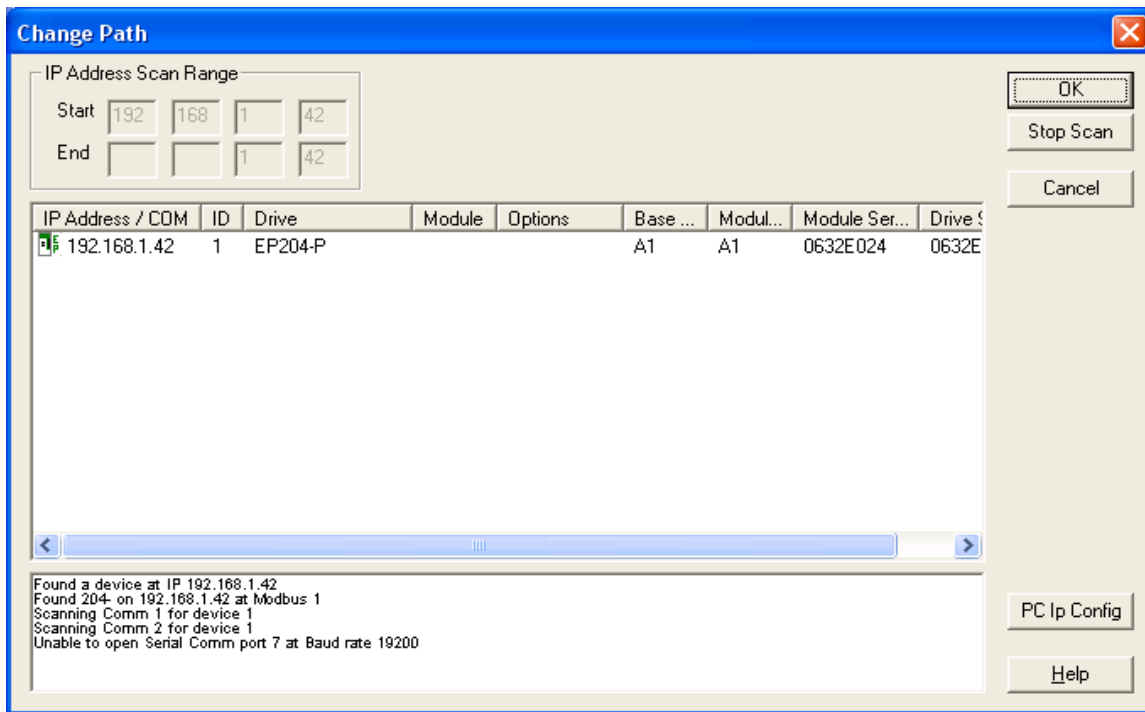


e. Click on Device



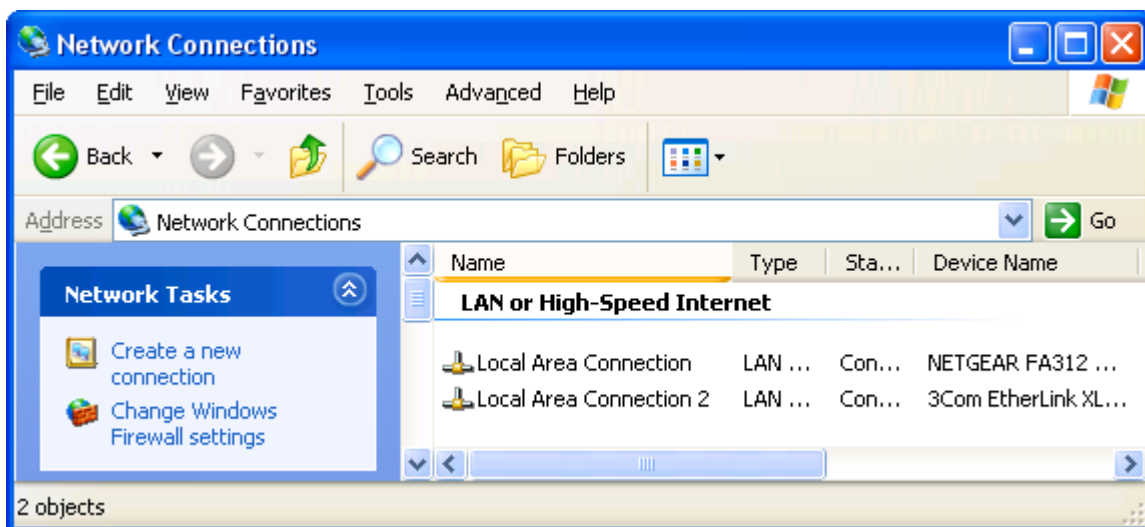
f. Then Change path.

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

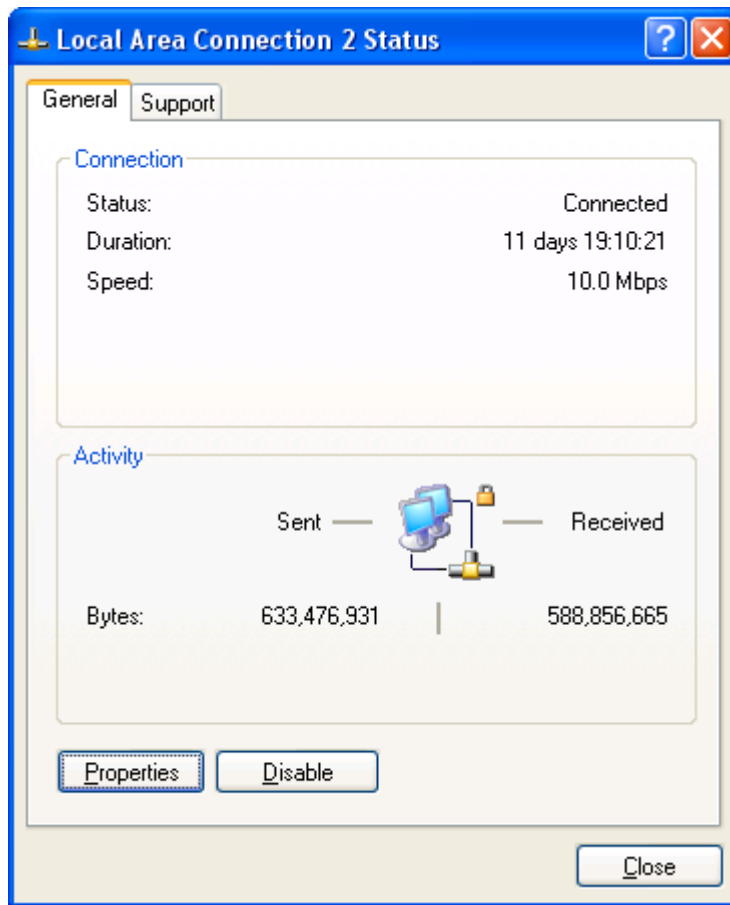


2. Setting up Ethernet port on PC

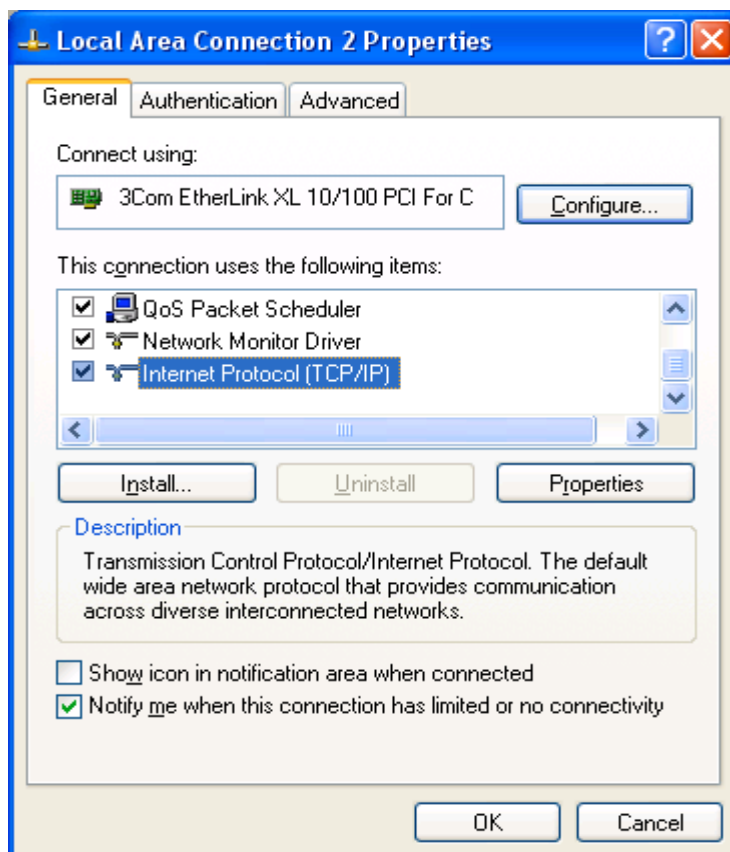
- a. Now that I know my device IP is 192.168.1.42, I'll use PC ID 192.168.001.001
- b. From the control panel I selected Network connections
- c. I have 2 LAN cards, connection 2, a 3com device has my static IP address, connection 1, a NETGEAR device has a server assigned IP and I don't want to booger that up.
- d. I Clicked on connection 2 to edit its IP.



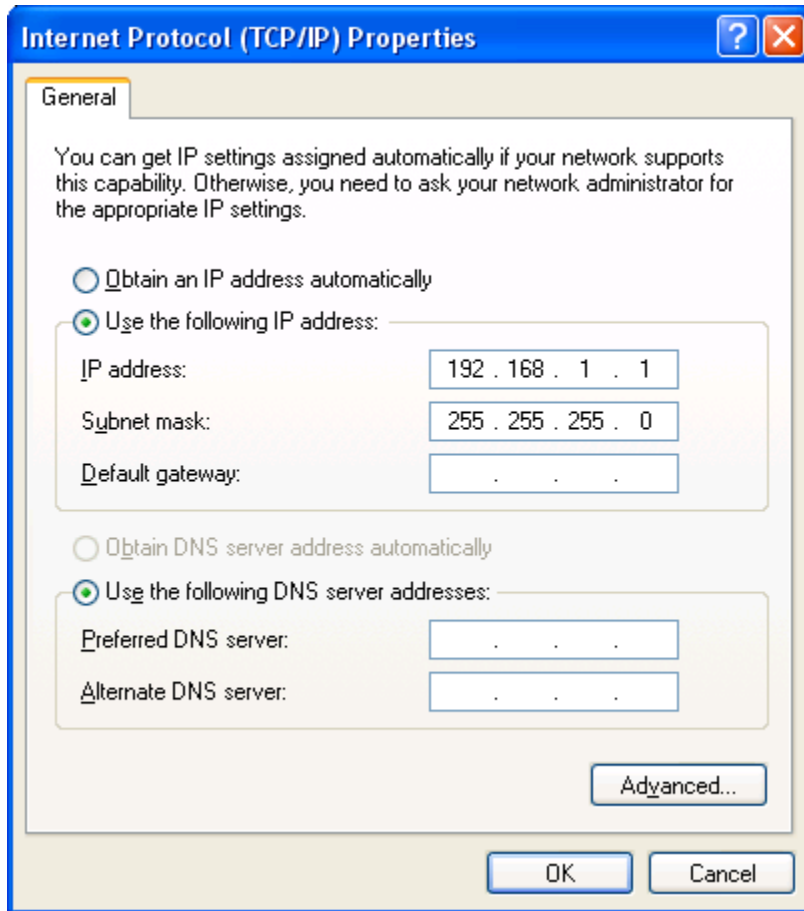
- e. Select properties



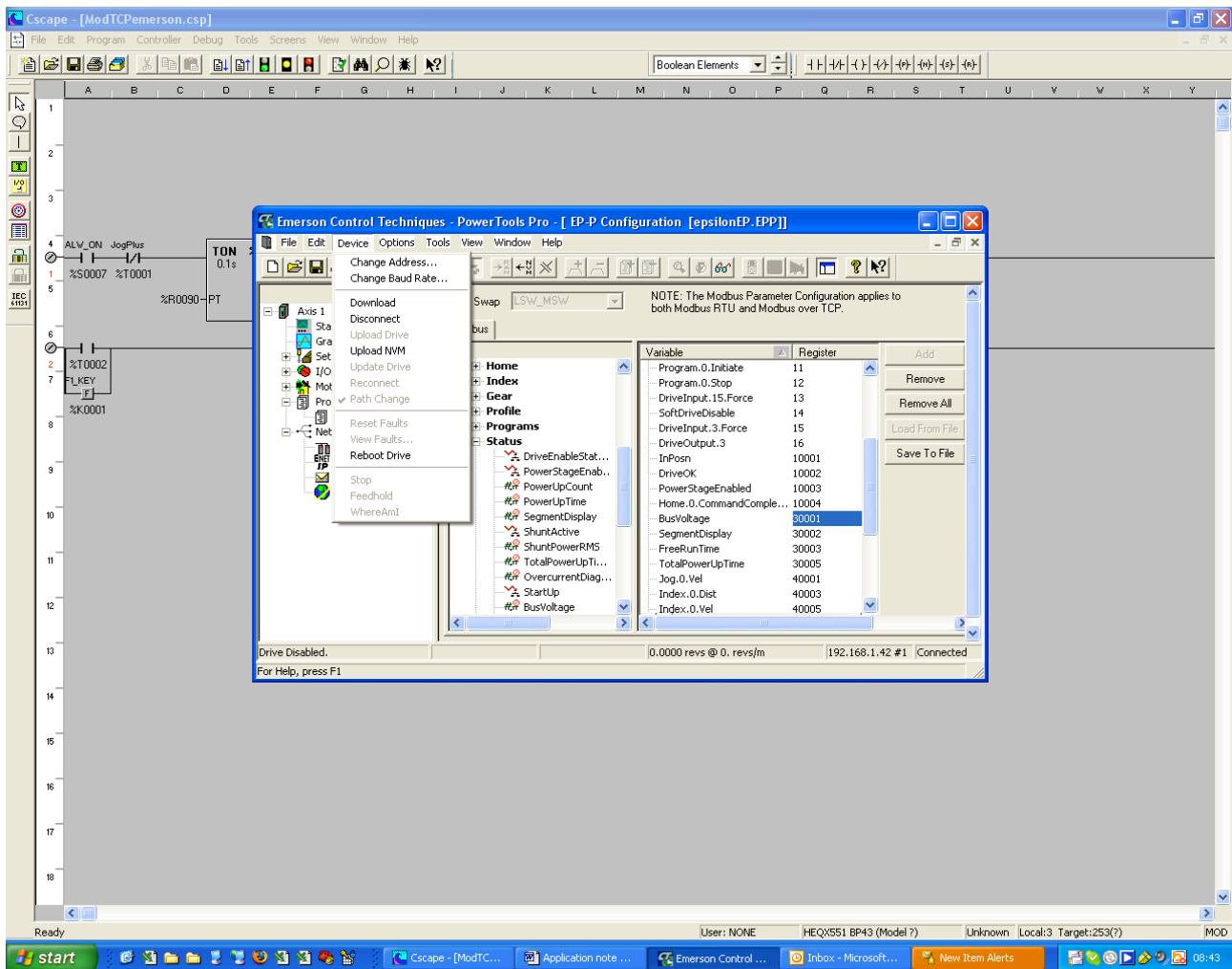
- f. Scroll down to expose and select Internet Protocol (TCP/IP)
- g. Then click properties



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

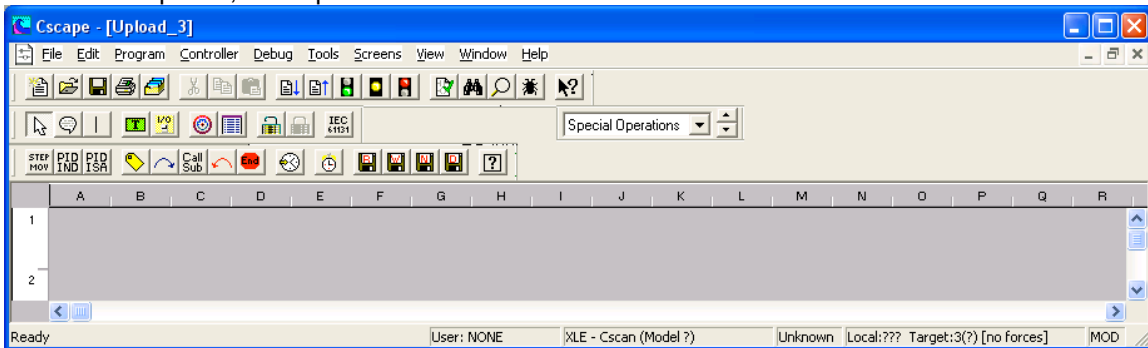


3. Setting up the drive
 - a. To get the Power Tools pro configured, establish a Path as described above,
 - b. When you see the address for this drive, click OK to trap the path, you should no longer see "change Path" in the status bar of Power Tools. Now it says 192.168.1.42 #1. if you do not see the 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.

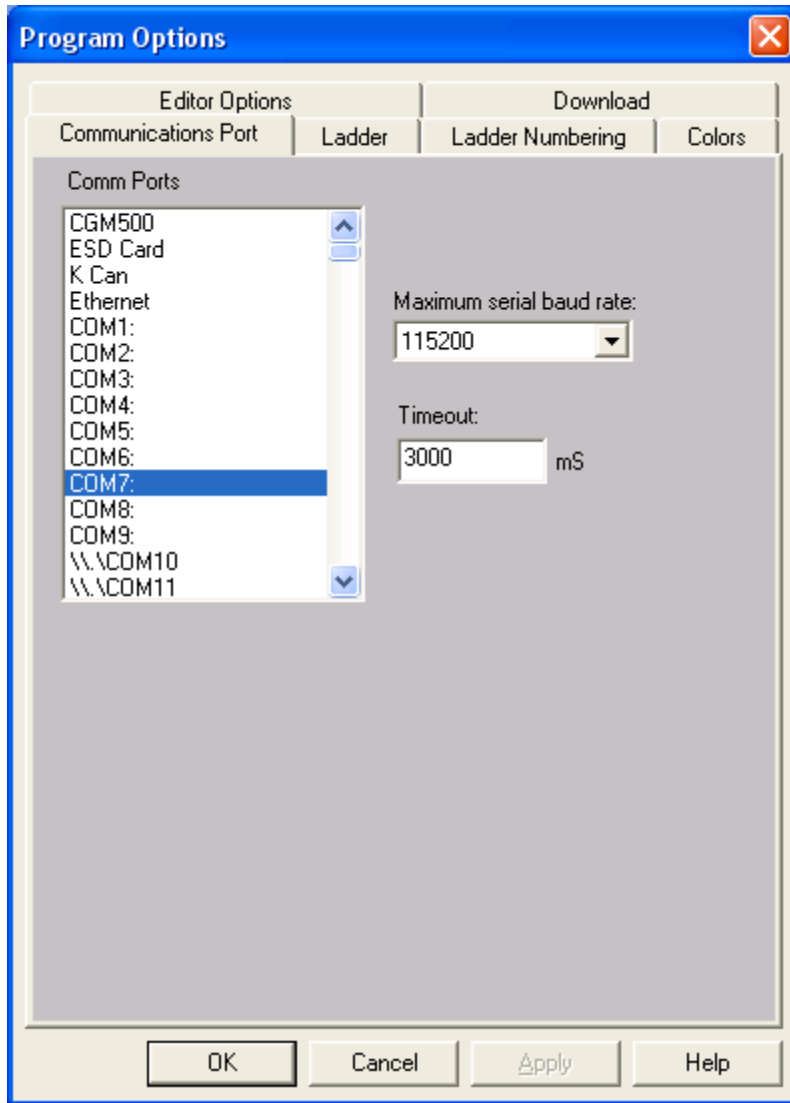


4. Set up serial communications to configure the OCS Ethernet Using Cscape Software. This is required to setup the Ethernet card if your planning to program the QX via Ethernet, keep in mind the data watch and debug and downloads will tax the network, time outs need to be considered when doing this. 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.

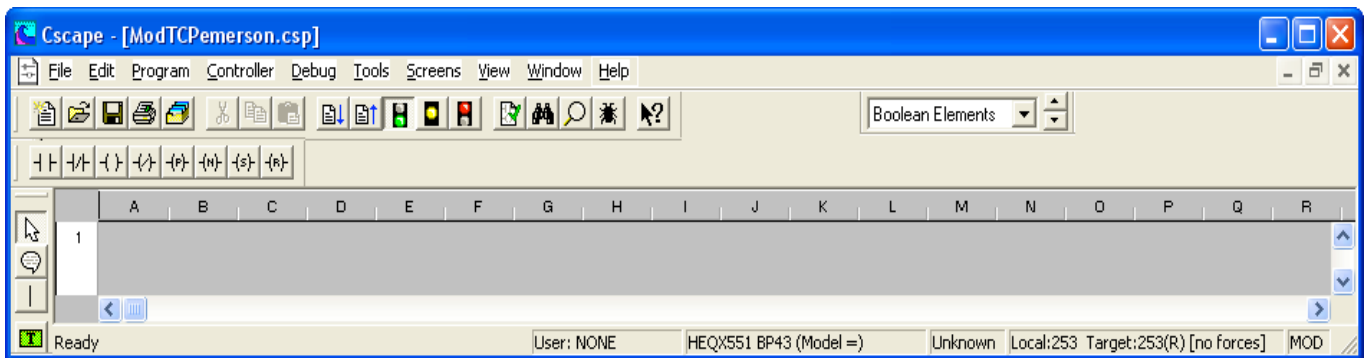
- a. Install the latest Cscape, in my case 8.11.0B.
- b. Select Tool options, serial port



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



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



5. Setting up the QX Ethernet port and to ditch the Serial communication
 - 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.

Module Configuration ✕

I/O Map **Module Setup**

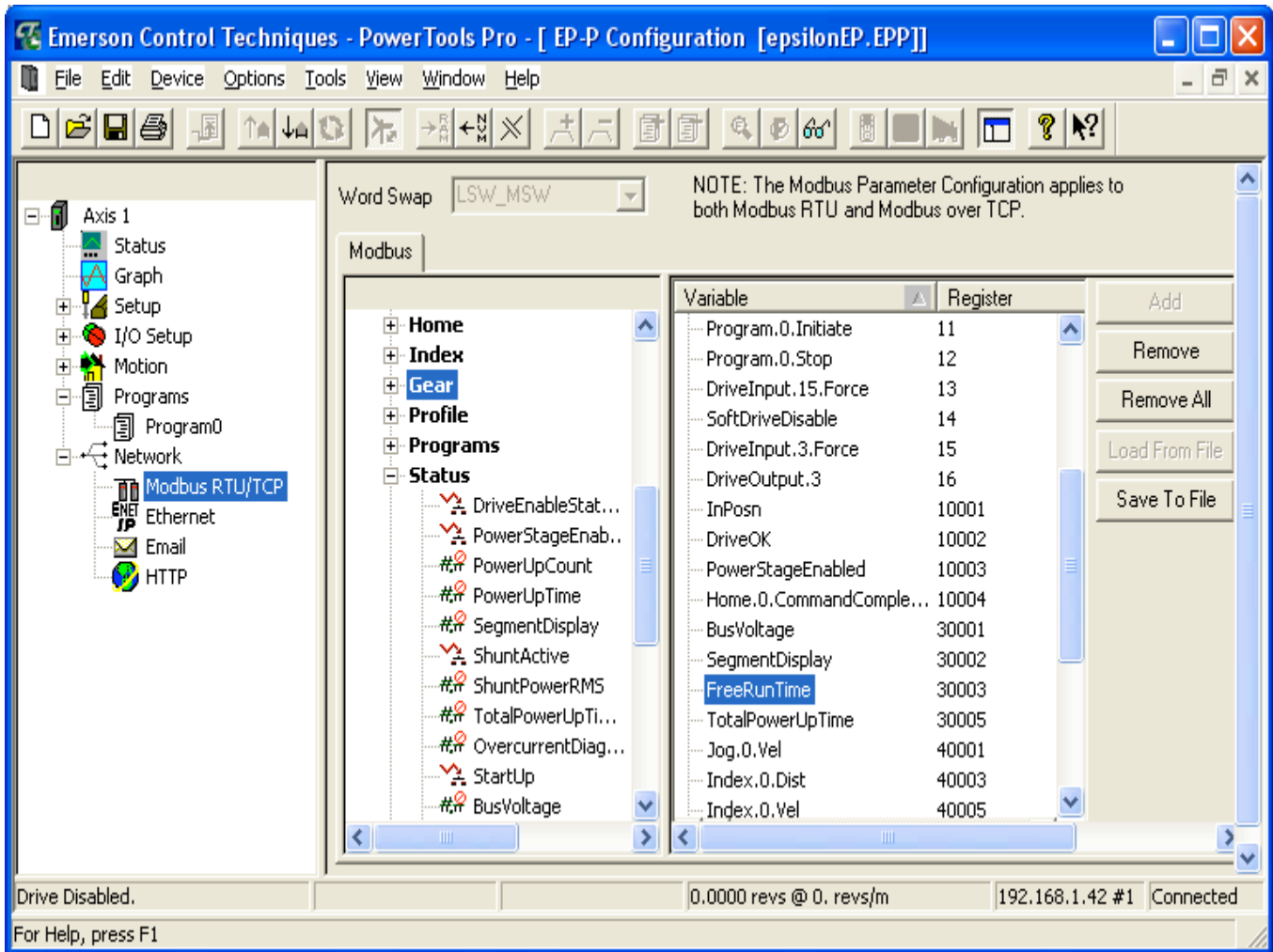
Register Usage

	Default Settings	Register	Direction	
IP Address:	192 . 168 . 1 . 20	R2000 32-BIT	Read Only	<input type="checkbox"/> Use CAN ID for last Octet
Net Mask:	255 . 255 . 255 . 0	32-BIT		<input type="checkbox"/> Enhanced Configuration
Gateway:	0 . 0 . 0 . 0	32-BIT		
Status:		R2002 16-BIT	Read Only	
Version:		R2003 16-BIT	Read Only	

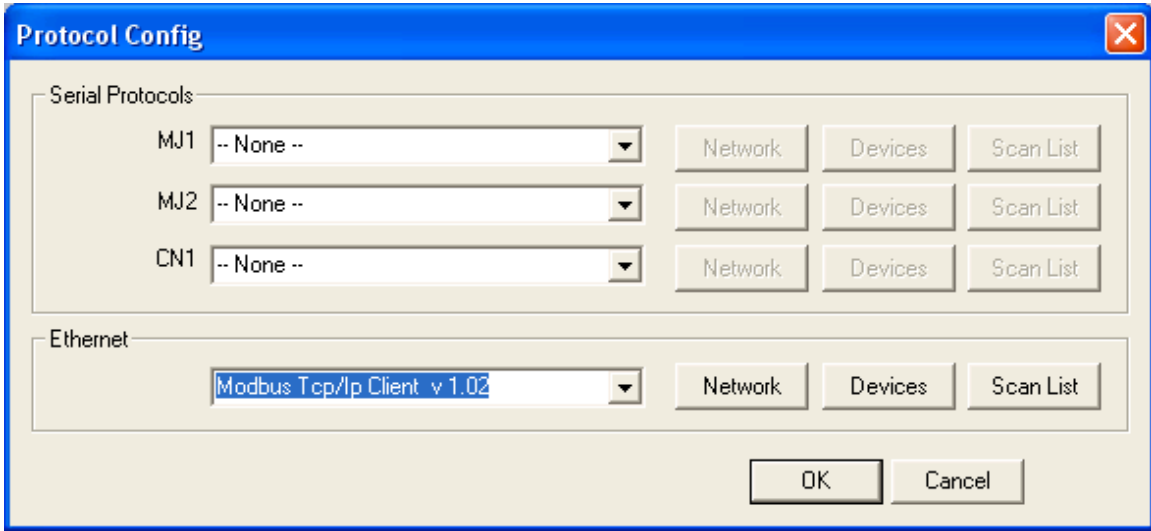
Protocol Support

- ICMP (Ping)
- EGD (Ethernet Global Data)
- SRTP Slave (90-30 Service Request)
- Modbus TCP Slave
- Ethernet/IP
- FTP (File Server)
- HTTP (Web Server)

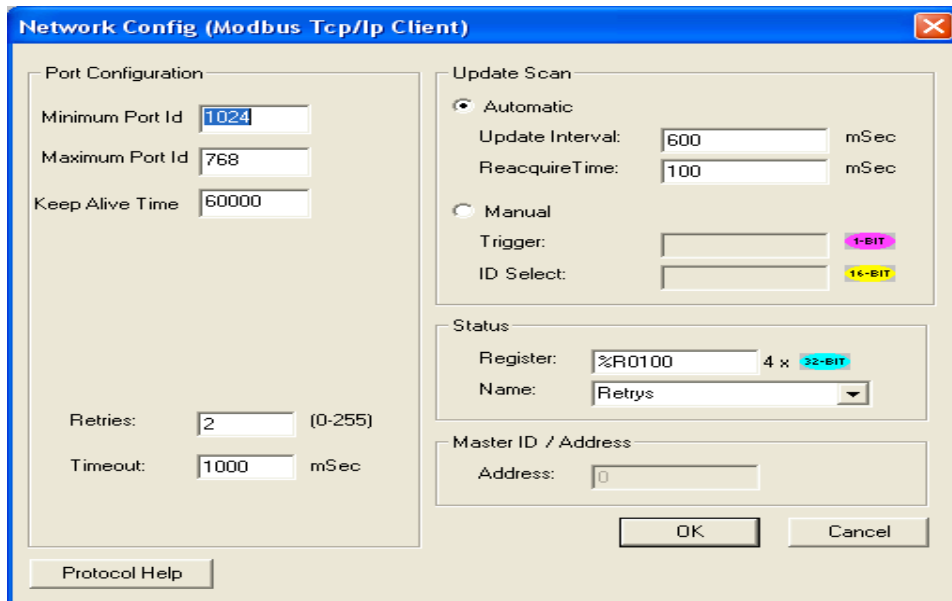
6. Determining what I want to read from the drive so I can setup my network master.
 - a. After uploading the drive parameters described above, I can then see what address I can read from this drive.
 - b. In the far left pane expand Axis 1 if not done so already, then Network, and select Modbus RTU/TCP.
 - 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 Cscope data watch



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



- 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 $(\text{Update} \times \text{retry}) + 1 \text{ update}$, R200 is updated with $-204 = \text{timeout}$, 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.



- k. Power Pro software suggested earlier that this device is ID 192.168.001.042. I named my device and gave it that IP
- l. I've enabled the status and assigned R200
- m. This will have R200 as a 16 bit integer and R201 as 16 bit integer
- n. I expect the R200 to stay 0 during good communications, and -204
- o. If I disconnect the cable. I expect R200 to go to -204 after 600mS+(600mS x 2Retries)
- p. It will jump start -204 back to 0 in 100mS as per the Reacquire time.

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
Name: Statemerson42
 Stop on Error 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

Data Mapping

Target

Device Name: EmersonDrive (192.168.1.42)

Device Register: 30002 > 32-bit access

Length: 2

Local

Register: %R0008

Name:

Update Type

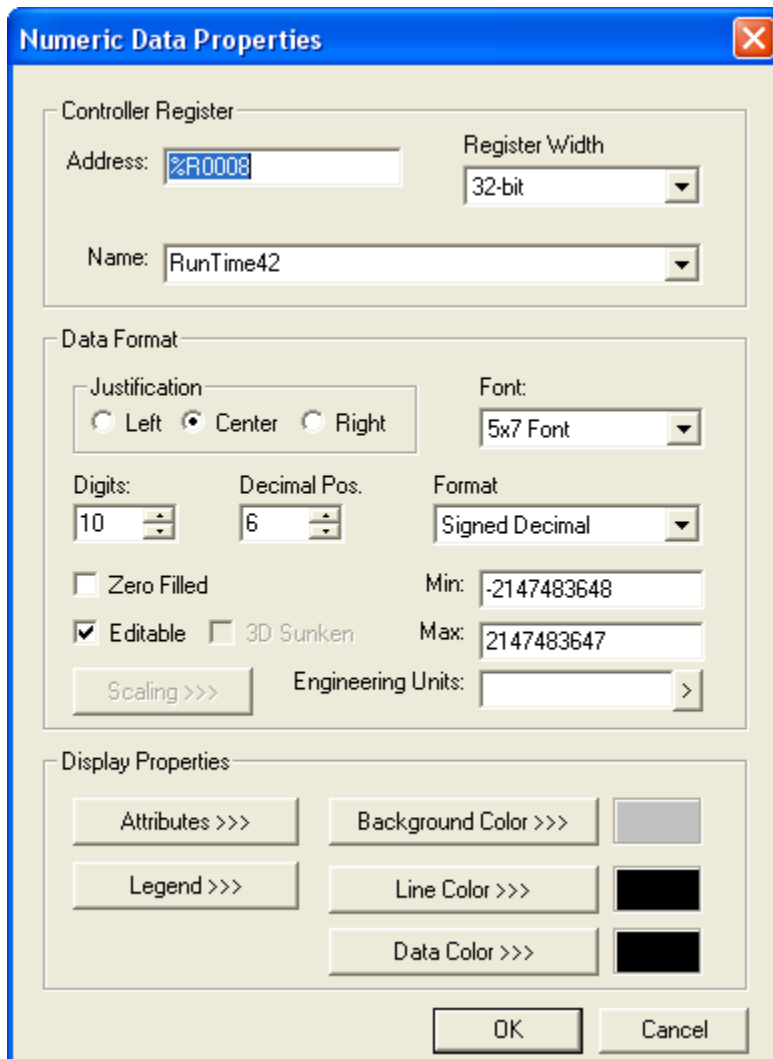
Polled Read Triggered Read

Polled Read/Write Triggered Write

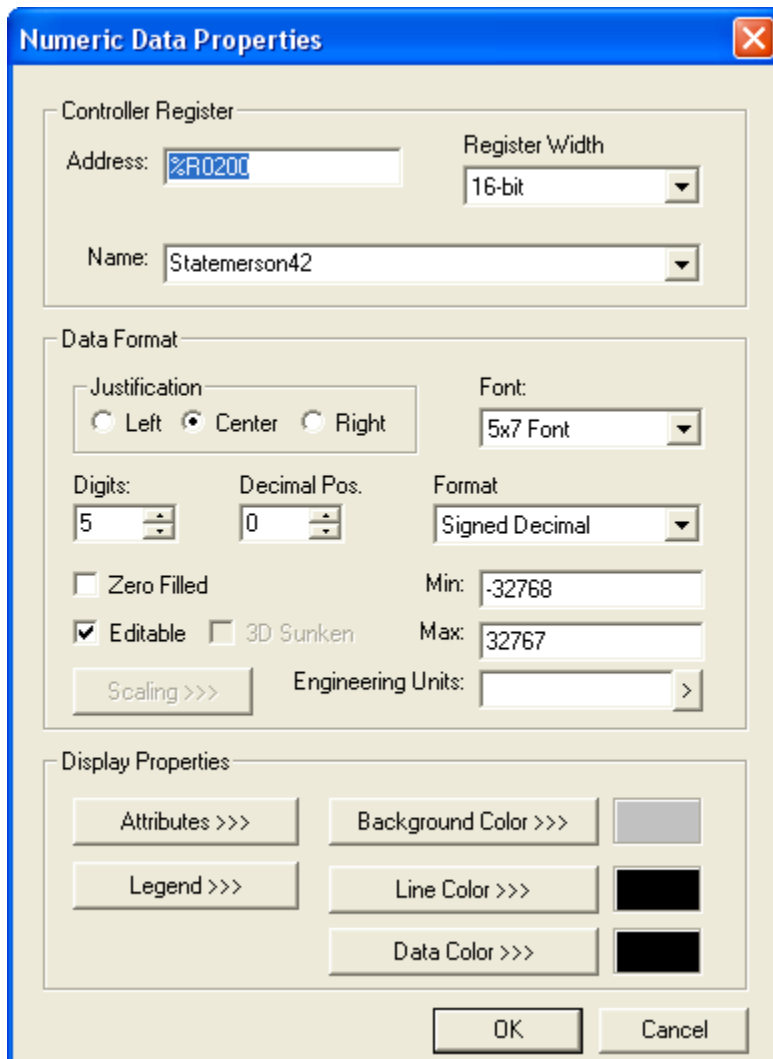
Polled Read/Write Init Trigger Register:

OK Cancel

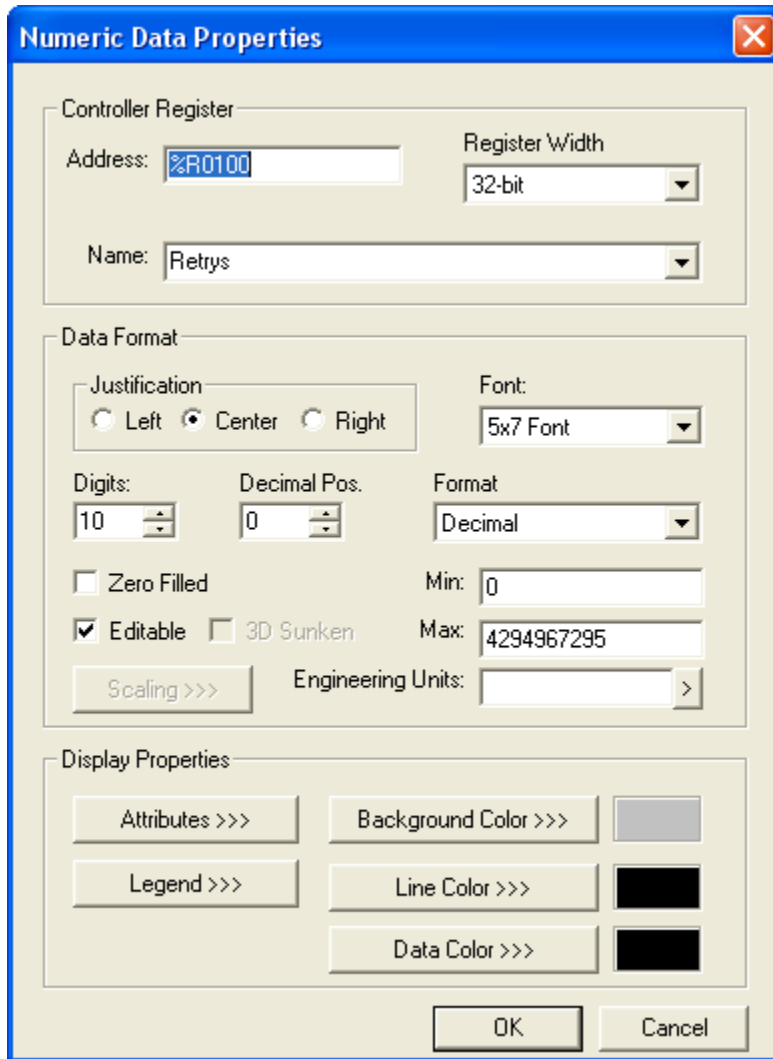
- w. In the Screen editor I've displayed R8 as 32bit Dint
- x. De-select editable and reselect editable to change the max and min values.
- y. I added 6 decimalials to make the screen jive with Power tools watch window.



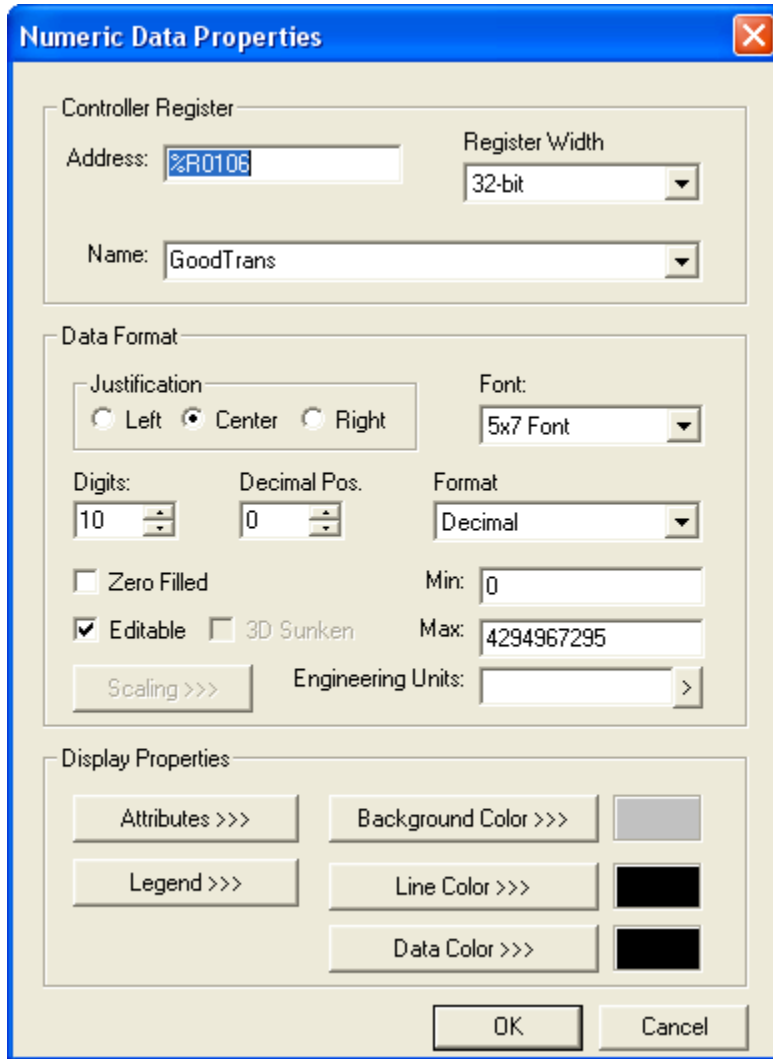
z. In the screens I'm displaying R200 the status for the device, this should be 0 if all is well and the LEDs are flashing with data.



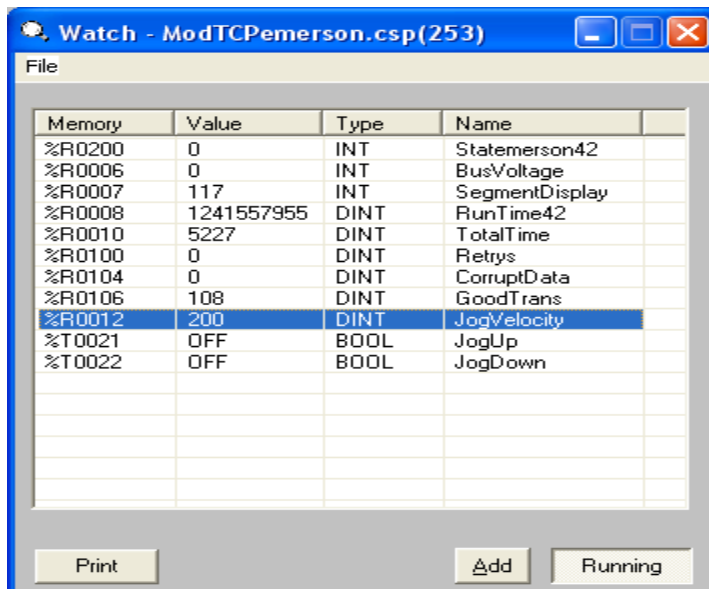
aa. I'm displaying R100 as 32bit dint to show me quality of connection, a 0 tells me all is perfect, any number suggest something took too long to get through and this counts how many times it took too long.



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



cc. Cscape Data watch I have



8. To see things working,
 - 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

Watch Window	
Axis Name	Axis 1
Axis Address	1
BusVoltage	0.0 volts
SegmentDisplay	117
TotalPowerUpTime	522.7 hrs
FreeRunTime	1246.058427 seconds
Jog.0.Vel	200 revs/m
Jog.MinusActivate	False
Jog.PlusActivate	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 techsppt@heapg.com.