Internet Connectivity with EMIT 3.0

1. Introduction to EMIT 3.0

emWare's EMIT™ (Embedded Micro Internetworking Technology) software is a system of software solution that allows many devices to be connected to the internet using the inexpensive but powerful PC of today as a middleman. EMIT defines a set of communication protocols using RS232/RS485 which allows any electronic devices that support this protocol to be accessed remotely via the internet. EMIT relieves the device of the chores of managing those CPU-intensive, memory-hungry TCP/IP stack in order to be linked to the internet.

The key to connecting the device to the internet is a piece of software called the "emGateway" which must be loaded on a PC running Windows 95/98/NT. The PC will be the one that actually connects to the internet via its local area network. What emGateway does is to make use of the internet/intranet socket established by the PC to transfer data between the device and a remote internet browser such as Netscape 4 or Internet Explorer 4. Any PC within the company's network can be used because emGateway runs in the background and hence does not require a dedicated PC to run it.

Instead of transferring just meaningless numbers, EMIT makes use of the Java technology to allow OEM to create a rich, graphical user interface in the form of a Java applet. When a remote browser accesses the device the Java applet will be transferred on the fly via the network or via the internet to the browser. The user will be presented with a graphical interface, regardless of where he is located. Since the Java applet runs on the browser (client) machine instead of at the server end, the response to changes is also faster with faster client machine.

Once the Java applet has been transferred to the browser, only binary data will be exchanged between the browser and the device, enabling quick response to changes. Compared to many SCADA based internet access solution, the EMIT solution is more elegant and less expensive. Not only the device can be accessed from any node within the corporate LAN or from anywhere in the world with an internet connection, there is also no need to install or pay license fee for the user interface at every node machine that has access to the device (unlike SCADA). The end users only need to pay license fee to emWare for the emGateway software.

2. T100M+ PLCs and EMIT 3.0

The EMIT 3.0 is a complete software package which includes assembly and C source codes known as "emMicro", to allow embedded system designer to incorporate emMicro code into their products. The device that incorporates emMicro will be able to communicate with the "emGateway". However, incorporation of the "emMicro" code into

individual device demands the programmer to have strong firmware skill and good understanding of the micro-controller architecture. The development time is also much longer which only makes sense for OEM who are designing high volume control system such as those used for refrigerator, air-conditioner and other home appliances, etc.

For small to mid-volume machine builders, the manpower requirement to design emMicro-enabled product from scratch is formidable. However, Triangle Research International has taken the lead to tackle the difficult part of the development work and come out with an elegant solution to let our OEM machine makers make use of EMIT technology easily.

What TRi has done is to license the emMicro code from emWare and incorporate them into our T100MD+ and T100MX+ PLCs. All the difficult issues of integrating emMicro into our device have already been resolved by our development team and hence there is no need for the PLC users to worry about integration of the emMicro anymore. The OEM users who design machines using T100M+ PLCs can concentrate on developing the Java interface, which is much easier to manage and can be handled by programmers with I.T. skill but not embedded firmware skill.

TRi integrates the emVariables used by EMIT into our easy to use TRiLOGI software version 4.1, and the entire system has been designed to be very forgiving. You can add internet connectivity as an afterthought long after the machine has been built, without the need for extensive modification to an already working software. OEM and end users will be pleased to know that machines designed with theT100MD+ and T100MX+ PLC are future proof - they can be integrated into the internet at a later date or as and when the need to do so arises. However, they do not have to make the difficult decision of deciding whether to build the machine using expensive PLC hardware with built-in internet capability, without knowing for sure whether this will be needed at a later date.

3. Obtaining and Installing EMIT 3.0

emWare Inc. produces an EMIT 3.0 SDK (Software Development Kit) to OEM users to develop EMIT-enabled products. The SDK comprises the emGateway software, the Symantec VisualCafe Java development software and emMicro source codes, etc.

If you wish to experiment with controlling your EMIT-enabled T100MD+ PLC, you can download a 60-day evaluation copy of the EMIT SDK software and 30-day trial version of the Symantec VisualCafe software from the following website:

http://www.emstore.com/freestuff.master.html

If emWare has moved the page, then try http://www.emstore.com.
To obtain other information about EMIT, visit http://www.emware.com.

Please follow the installation instructions to install emGateway on your PC. You will need to install the emGateway on your PC which runs MS Windows 95/98/NT before you can experiment with the demo programs that we have created to demonstrate the control and monitoring of a T100MD1616+ PLC using a Netscape or IE4 browser. When the emGateway is properly installed and loaded you will see a red ball with the words "em" appearing at the bottom right corner of the screen. There should not be a big 'X' on the red ball otherwise it indicates that the emGateway is not running properly because the TCP/IP Stack has not been initialized (try to assign an IP address to the PC even if it is not networked, you can do so using the Control Panel).

4. Installing Demonstration Files

Next, check your TRiLOGI installation diskette for a file named "INTERNET.ZIP" or download the file from:

http://www.tri-plc.com/internet.zip

You will need the WINZIP program to unzip the files. Winzip allows you to select the directory to unzip each file. You should unzip the following files to the corresponding directory as shown below:

File	location to Unzip to
INTERNET.PC4	c:\trilogi\tl4\
DEFAULTPAGE.JAR	c:\emware\emgateway\html\
DEFAULTPAGE.Java DEFAULTPAGE.VEP	c:\visualcafewde\projects\tri\

Note: If you have installed TRiLOGI, emGateway or VisualCafe in directories different from the above then please substitute the above location with the actual path name.

The file "defaultpage.jar" is a Java archive file and it must be copied into the c:\[emware path name]\emGateway\html\ directory so that the browser can retrieve it when required. After you have installed the "INTERNET.PC4" file into the TRiLOGI directory, run TRiLOGI 4.1 and transfer this program into your T100MD1616+ PLC. Please use the "Controller -> Target Access -> Write ID Address" command to **set the ID address of your PLC to ID = 01.**

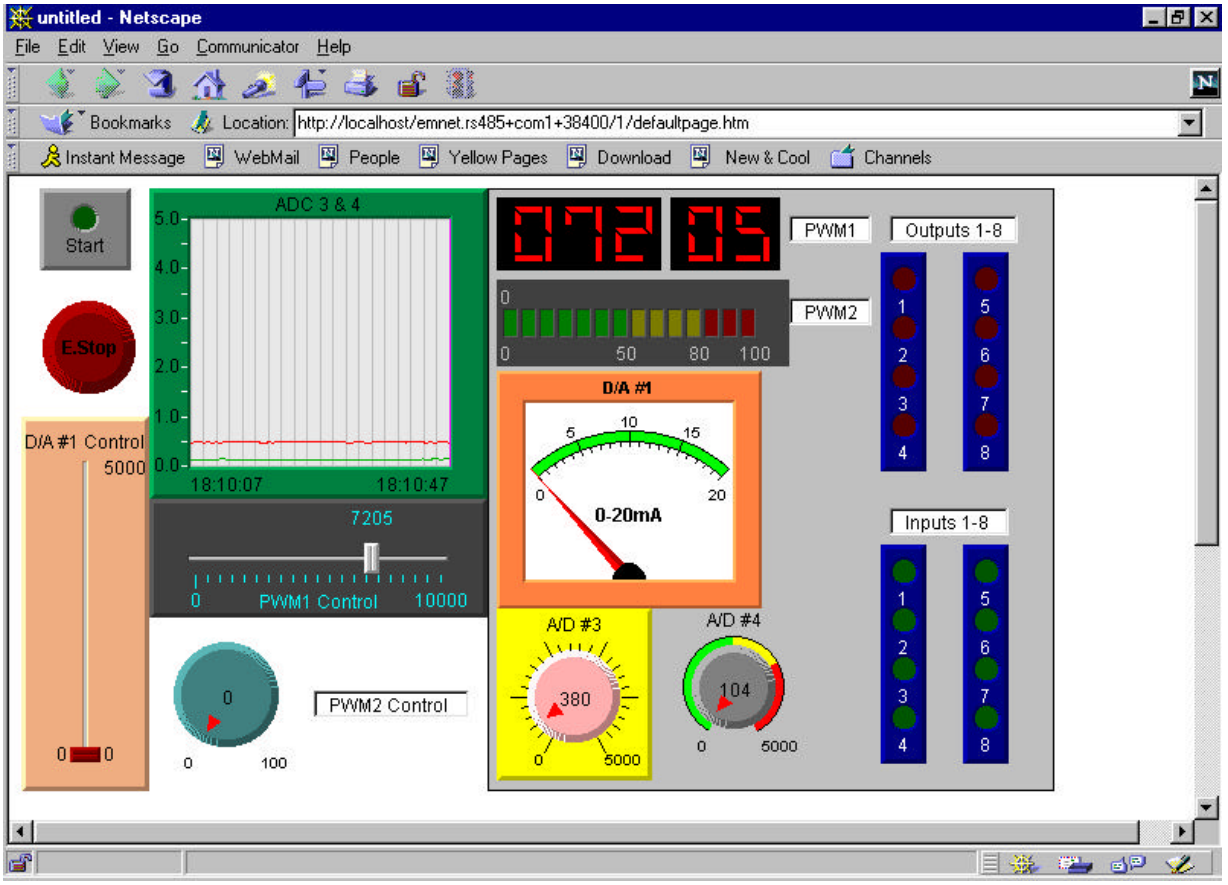
5. Running Internet Demonstration

We will first try to run the demonstration on localhost, which means using the Netscape browser on the same PC where emGateway is running. Once test on localhost is successful you can extend the test to the actual intranet or internet by substituting the "localhost" with the real IP address of the PC that runs the emGateway.

a) Connect serial port COM1: of your PC to COMM1 of the T100MD1616+. (Note: if you are using T100MX, you will need a special cable which provides external +9V power to pin 4 of the DB9 connector to power the opto-isolated RS232 interface of T100MX PLCs. Unlike TRiLOGI, emGateway does not automatically supply power to pin 4, which is necessary for the opto-isolated RS232 interface to work. There is no such requirement for T100MD+ since its RS232 port is not opto-isolated.)

b) Run the Netscape browser version 4.0 and above or IE4 and above. Type in the following URL at the Netscape "Location" entry box:

http://localhost/emnet.rs485+com1+38400/1/defaultpage.htm



c) If everything goes well you should see the message "Starting Java.." being displayed at the bottom left of the browser and after about a minute the Java applet shown in Figure 6.1 should appear on the browser window.

d) First of all, click on the "Start" button, the outputs 1,3, 5 of the PLC should lights up. Click Stop button to turn them OFF. Observed the changes of the output being reflected on the on screen indicator lamp marked "Outputs 1-8".

e) Now pull the slider with the label "PWM 1 Control" to the right. Observe the red LED of PWM #1 (output 7) on the T100MD1616+ PLC. Its intensity should change as you pull the slider arm around. The percentage duty cycle of PWM 1 is shown on the slider as well as on the 7 segment LED which was programmed to display the value of the variable that control the PWM1. However, note that the on screen lamp of output #7 does not change - it is not supposed to because the output #7 is being used as PWM1 and hence is not the same as output #7 being turned ON.

f) Next, click on the red indicator on the blue knob marked "PWM2 Control". Do not release the mouse, use the mouse to rotate the dial and PWM 2 should lights up with varying intensity according to the position of the knob. The present setting is shown on both the knob and on an LED bar-graph.

g) Analog output #1 can be controlled by the slider marked "D/A #1". You will need to connect power to the analog section and use a multi-meter to measure the 0-20mA current loop from analog output 1 when you slide the slider.

h) Connect a 1K potentiometer to ADC #3 and another 1K potentiometer to ADC #4. When you turn the potentiometer knobs, observe that the corresponding graphical "knobs" on the screen will also turn. In addition, the value of ADC #3 and #4 are being continuously recorded on the time chart.

6. Creating Your Own Java User Interface Applet

emWare has pre-created a number of Java objects such as slider, switches, indicator lamps, etc. They called these "emObjects" which are provided together with the licensed version of EMIT 3.0 SDK or available for sales separately. We have used the emObjects extensively to create our demonstration applet. You can create your own Java applet quite easily using the VisualCafe Java development system with the emObjects loaded. You will have to follow the instruction provided by VisualCafe and EMIT to connect the objects to emVariables. Please refer to TBASIC Reference manual Chapter 3 subsection "4. Link Variables for EMIT 3.0 (Internet Connectivity)" for the name of the emVariables in TBASIC and their corresponding names to emGateway. The demonstration files "`defaultpage.java`" and "`INTERNET.PC4`" should provide a good reference for creating your own Java applet to control a T100MD1616+ from the internet.