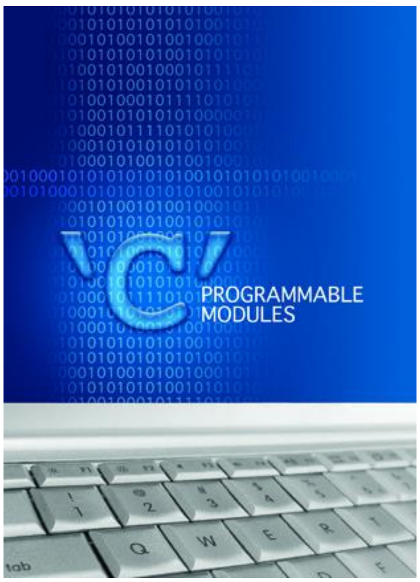
Where Automation Connects.



MVI69E-LDM

"C" Programmable

Linux® Application Development Module

August 3, 2020

DEVELOPER'S GUIDE

Your Feedback Please

We always want you to feel that you made the right decision to use our products. If you have suggestions, comments, compliments or complaints about our products, documentation, or support, please write or call us.

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MVI69E-LDM Developer's Guide

August 3, 2020

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided at:
www.prosoft-technology.com

For professional users in the European Union
If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

Prop 65 Warning – Cancer and Reproductive Harm – www.P65Warnings.ca.gov

MVI (Multi Vendor Interface) Modules

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DÉCONNECTER L'ÉQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DÉSIGNÉ NON DANGEREUX.

Important Installation Instructions

Power, Input, and Output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods, Article 501-4 (b) of the National Electrical Code, NFPA 70 for installation in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations in Canada, and in accordance with the authority having jurisdiction. The following warnings must be heeded:

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2;

WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

Class 2 Power

Warnings, Specification, and Certifications

North America Warnings

A Warning - Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2.
B Warning - Explosion Hazard - When in Hazardous Locations, turn off power before replacing or rewiring modules.
C Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
D Suitable for use in Class I, Division 2 Groups A, B, C and D Hazardous Locations or Non-Hazardous Locations only.
E The subject devices are powered by a Switch Model Power Supply (SMPS) that has a regulated output voltage of 5 VDC.

ATEX Warnings and Conditions of Safe Usage:

Power, Input, and Output (I/O) wiring must be in accordance with the authority having jurisdiction

A Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or wiring modules.
B Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
C These products are intended to be mounted in an IP54 enclosure. The devices shall provide external means to prevent the rated voltage being exceeded by transient disturbances of more than 40%. This device must be used only with ATEX certified backplanes.
D DO NOT OPEN WHEN ENERGIZED.

China RoHS Hazardous Material Declaration Table

产品中有害物质的名称及含量
Name and content of hazardous substances in product

部件名称 Component Name	有害物质					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr(VI))	多溴联苯 Polybrominated Biphenyls (PBB)	多溴二苯醚 Polybrominated Diphenyl Ethers (PBDE)
印刷电路板组件 Printed Circuit Board Assemblies	X	O	O	O	O	O
金属部件 Metal Components	X	O	O	O	O	O
电池 Battery	O	O	O	O	O	O
塑料部件 Plastic Components	O	O	O	O	O	O

本表格依据SJ/T 11364的规定编制。This table is made per guidance of SJ/T 11364
X: 表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。
(企业可在此处，根据实际情况对上表中打"X"的技术原因进行进一步说明。)

Agency Approvals & Certifications

Please visit our website: www.prosoft-technology.com

Contents

1 Preparing the MVI69E-LDM Module

1.1 MVI69E-LDM Introduction

The MVI69E-LDM module is a CompactLogix backplane-compatible module that allows Rockwell Automation CompactLogix processors to interface with relatively any Ethernet or Serial device. With the supplied development tools and example applications, you are the developer that controls exactly what this module can and cannot do.

ProSoft Technology's Linux Development modules make it possible for you to easily develop and deploy C/C++ applications that interface with Bar Code Scanners, Legacy ASCII protocols, Terminal Port Emulation, Printer Drivers (Alarm/Status printer), or any other device requiring custom or proprietary Ethernet and Serial communications.

This document provides the information you need to develop application programs for the MVI69E-LDM module.

This document assumes you are familiar with software development in the Linux environment using the C/C++ programming languages. This document also assumes that you are familiar with Rockwell Automation programmable controllers and the CompactLogix platform.

You should be familiar with the following terms:

Term	Description
API	Application Programming Interface
Backplane	Refers to the electrical interface or bus to which modules connect when inserted into the rack. The MVI69E-LDM communicates with the control processor(s) through the CompactLogix backplane.
CIP	Control and Information Protocol. This is the messaging protocol used for communications over the CompactLogix backplane.
Connection	A logical binding between two objects. A connection allows more efficient use of bandwidth because the messaging path is not included after the connection is established.
Consumer	A destination for data.
Library	Refers to the library file (DLL) that contains the API functions. The library must be linked with the developer's application code to create the final executable program.
Originator	A client that establishes a connection path to a target.
Producer	A source of data.
Target	The end-node to which a connection is established by an originator.

1.2 Specifications

CPU, Memory, and OS

- **CPU:** 400MHz ARM9 G20
- **Operating System**: Linux (kernel 2.6.22)
- **Linux Distribution:** BusyBox
- **System Memory:** 64MB SDRAM
- **Flash Memory**: 256MB NAND Flash

General

- **Backplane Current Load:** 500 mA @ 5 VDC; 3mA @ 24 VDC
- **Operating Temperature:** 0 to 60°C (32 to 140°F)
- **Storage Temperature:** -40 to 85°C (-40 to 185°F)
- **Shock:** 30g non-operational; 15g non-operational; Vibration: 5 g from 10 to 150 Hz
- **Relative Humidity:** 5% to 95% (without condensation)
- **LED Indicators:** ETH - Application driven, P1 Application Driven, P2 Application driven, CFG - Application driven, BP - Application driven, OK - Application driven

Ethernet Ports

- 1 Ethernet port
- 10/100 Mbps
- RJ45 connector
- Link and Activity indicators
- Auto-sensing crossover cable detection

Serial Ports

- Full hardware handshaking control provides radio, modem, and multi-drop support.
- Serial Application ports: RJ45 (DB-9M with supplied adapter cable)
- Configurable RS-232 hardware handshaking
- 500V Optical isolation from backplane
- RS-232, RS-422, RS-485 (software configurable by the end user)
- Rx (Receive) and Tx (Transmit) LEDs, each port

1.3 System Requirements

The MVI69E-LDM module requires the following hardware and software components:

- Rockwell Automation CompactLogix processor (firmware version 18 or greater depending on processor type) with compatible power supply and one free slot in the rack for the module. The module requires 5 VDC power
- Rockwell Automation RSLogix 5000 software
- Rockwell Automation RSLinx communication software version 2.51 or greater
- Pentium II 450 MHz minimum. Pentium III 733 MHz or greater recommended
- Supported operating systems:
  - Microsoft Windows 10
  - Microsoft Windows 7 Professional (32-or 64-bit)
  - Microsoft Windows XP Professional with Service Pack 1 or 2
  - Microsoft Windows Vista
  - Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
  - Microsoft Windows Server 2003
- 128 MB RAM (minimum), 256 MB of RAM recommended
- 100 MB of free hard disk space (or more based on application requirements)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 x 768 recommended)

Note: The Hardware and Operating System requirements in this list are the minimum recommended to install and run software provided by ProSoft Technology. Other third party applications may have different requirements. Refer to the documentation for any third party applications.

1.4 Package Contents

Your MVI69E-LDM package includes:

- RJ45 to DB-9M cables for each serial port
- (2) DB9 to screw terminal adapter
- Null Modem Cable

You can download all documentation, sample code, and sample ladder logic from our website for free (www.prosoft-technology.com/ldmdevkit).

If any of these components are missing, please contact ProSoft Technology Support.

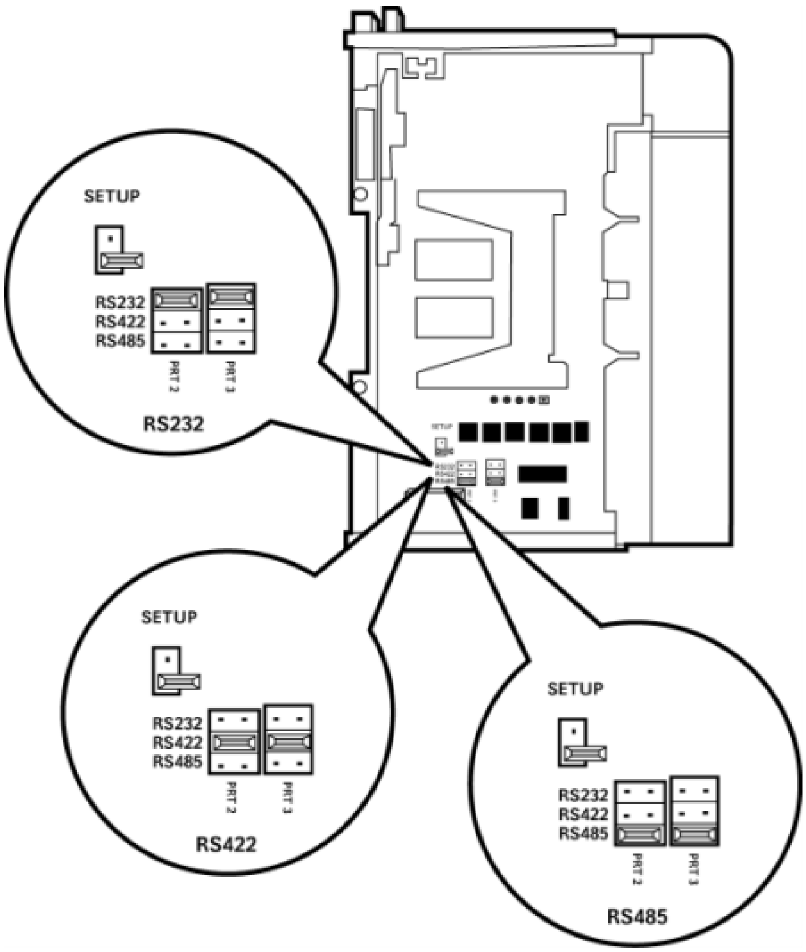
Not Shipped with Unit

- LDMdevKit - Linux Development Module Development Kit (Available for purchase from ProSoft Technology and must be ordered separately.)

1.5 Jumper Locations and Settings

Each module has three jumpers:

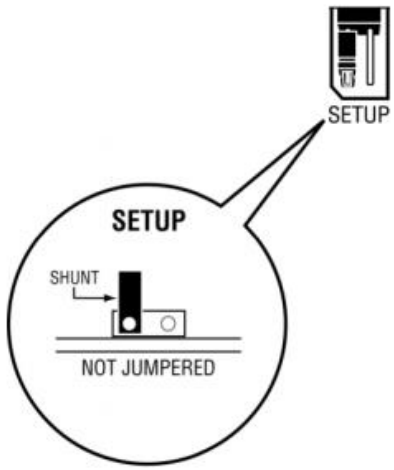
- Setup
- Port 1
- Port 2



1.5.1 Setup Jumper

The Setup Jumper acts a write protection for the module's firmware. In "write-protected" mode, the setup pins are not connected which prevents the module's firmware from being overwritten.

The module is shipped with the Setup Jumper OFF. If you need to update the firmware or run a module rescue (recovery), apply the setup shunt over both pins.



1.5.2 Port 1 and Port 2 Jumpers

These jumpers, located at the bottom of the module, aid in configuring the port settings to RS-232, RS-422, or RS-485. The "RS-232", "RS-485", and "RS-422" labels are there for convenience. The jumpers simply send a high/low signal when jumped or not jumped. The jumper configuration is read by the API, and the application code must change the appropriate port settings to the required mode (232, 485, 422).

1.6 Installing and Connecting the Module

If you have not already done so, please install and configure your CompactLogix processor and power supply. Refer to the Rockwell Automation product documentation for installation instructions.

Warning: You must follow all safety instructions when installing this or any other electronic devices. Failure to follow safety procedures could result in damage to hardware or data, or even serious injury or death to personnel. Refer to the documentation for each device you plan to connect to verify that suitable safety procedures are in place before installing or servicing this device.

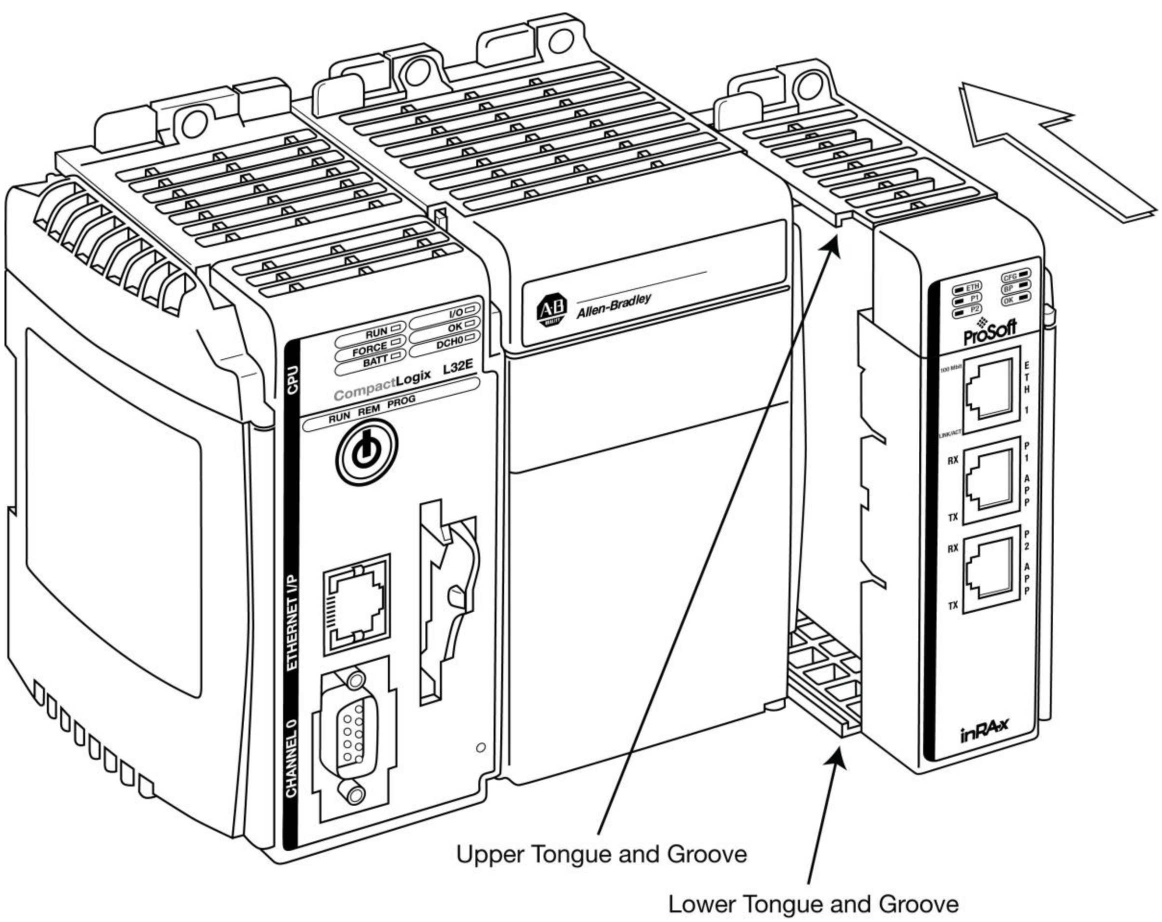
After verifying proper jumper placement, insert the module into the CompactLogix chassis. Use the same technique recommended by Rockwell Automation to remove and install CompactLogix modules.

1.6.1 Installing the Module in the Chassis

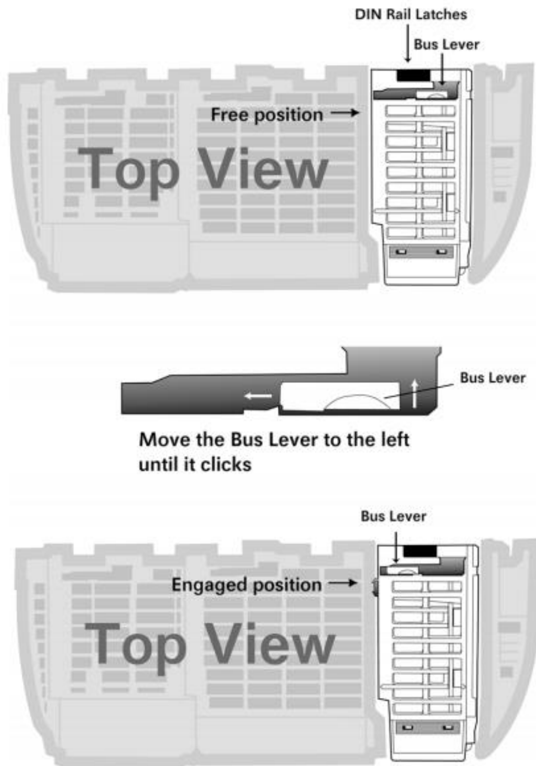
You can install or remove CompactLogix system components while chassis power is applied and the system is operating. However, please note the following warning.

Warning: When you insert or remove the module while backplane power is on, an electrical arc can cause personal injury or property damage by sending an erroneous signal to your system's actuators. This can cause unintended machine motion or loss of process control. Electrical arcs may also cause an explosion they occur in a hazardous environment. Verify that power is removed, or that the area is non-hazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

1 Align the module using the upper and lower tongue-and-groove slots with the adjacent module and slide forward in the direction of the arrow.

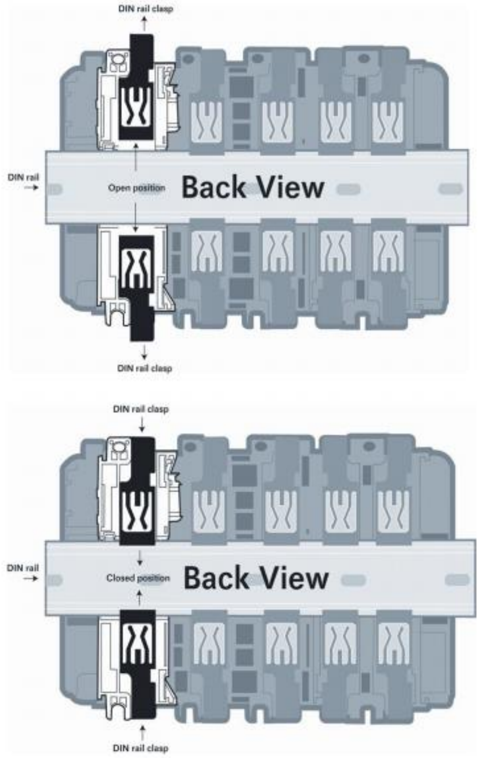


2 Move the module back along the tongue-and-groove slots until the bus connectors on the MVI69E module and the adjacent module line up with each other. Push the module's bus lever back slightly to clear the positioning tab and move it firmly to the left until it clicks. Ensure that it is locked firmly into place.

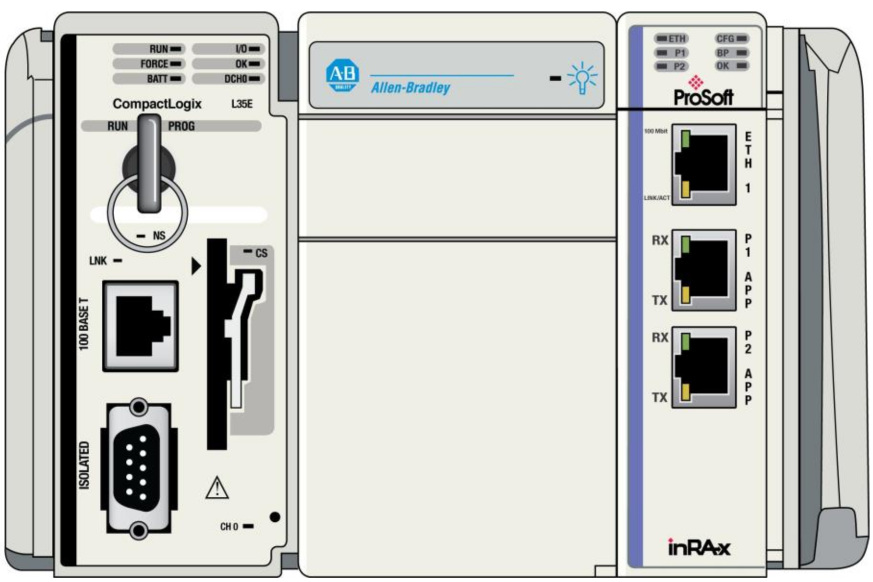


3 Close all DIN-rail latches.

4 Press the DIN-rail mounting area of the controller against the DIN-rail. The latches momentarily open and lock into place.



Module inserted.

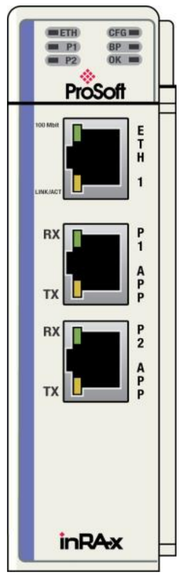


1.6.2 Making Configuration Port Connections

You can communicate with the module via RS-232 through the Console or through the Ethernet port using Telnet.

RS-232 Console

You access the Console through Serial Port 1. As a default, the RS-232 Console port is enabled. You can disable or enable this port. Refer to *Enabling and Disabling the Console Port* in the next section.



1. Connect the RJ45 end of an RJ45 - DB9m cable (*Cable 14*) to the Serial Port 1 of the module.
2. Connect one end of the Null Modem Cable (*Cable 15*) to the DB9m end Cable 14.
3. Connect the other end of Cable 15 (*null modem cable*) to a serial port on your PC or laptop.

Ethernet Port

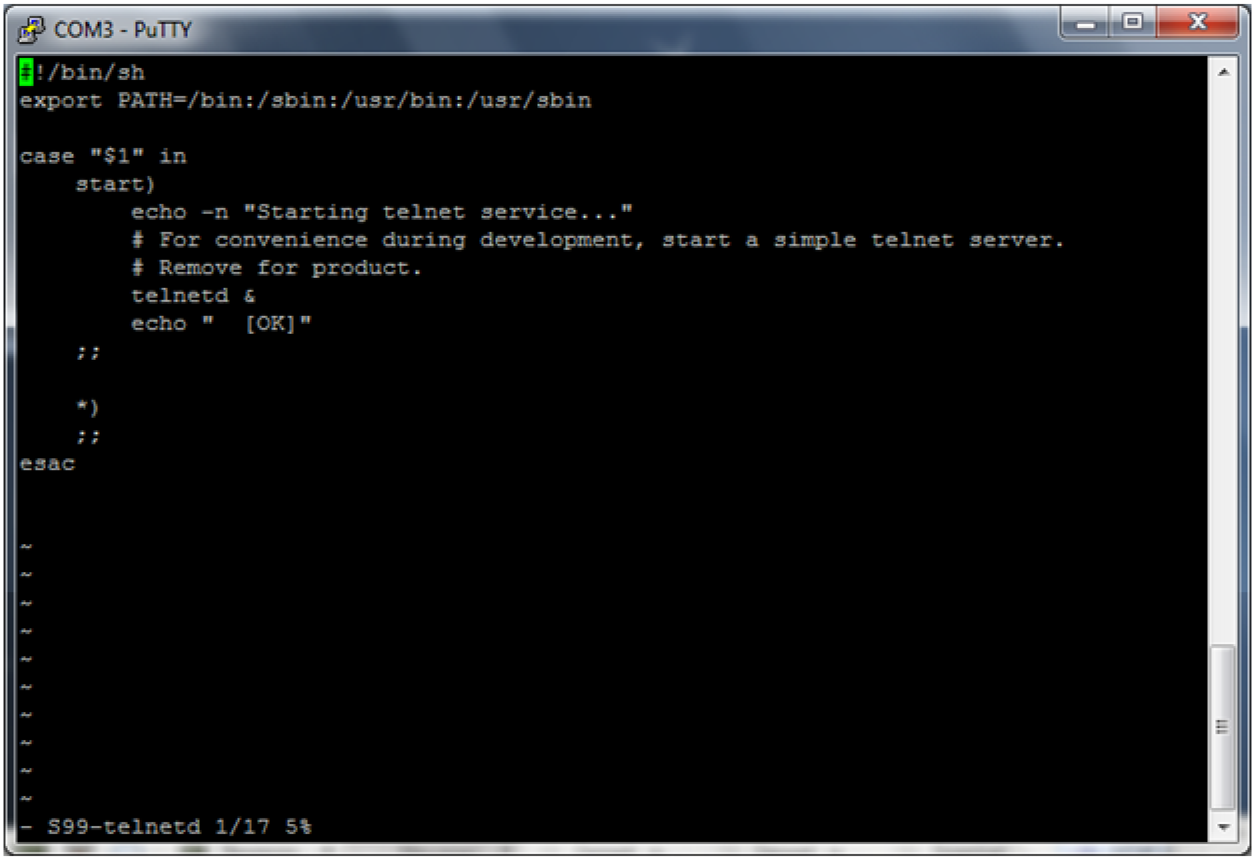
1. The module contains a Telnet client which you can access through Ethernet Port 1 (Eth 1) as shown.
2. Connect an Ethernet RJ45 cable to the Eth 1 port of the module and the other end to the Ethernet network switch.

To enable or disable the Telnet port:

This example uses PuTTY, which you can download for free at from:
http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

1 Start PuTTY.

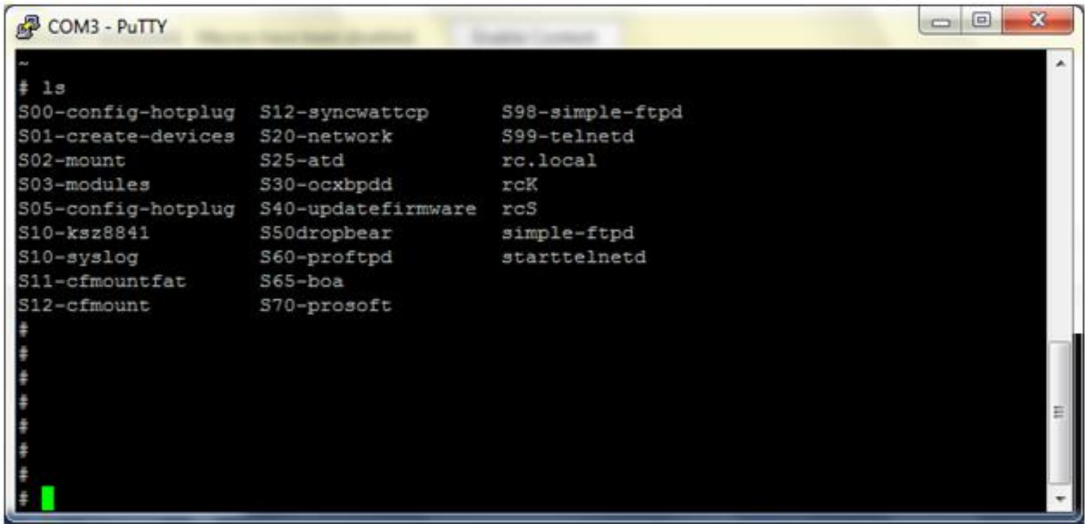
2 Open a PuTTY session as shown below. The following screenshot shows the Telnet Port enabled.



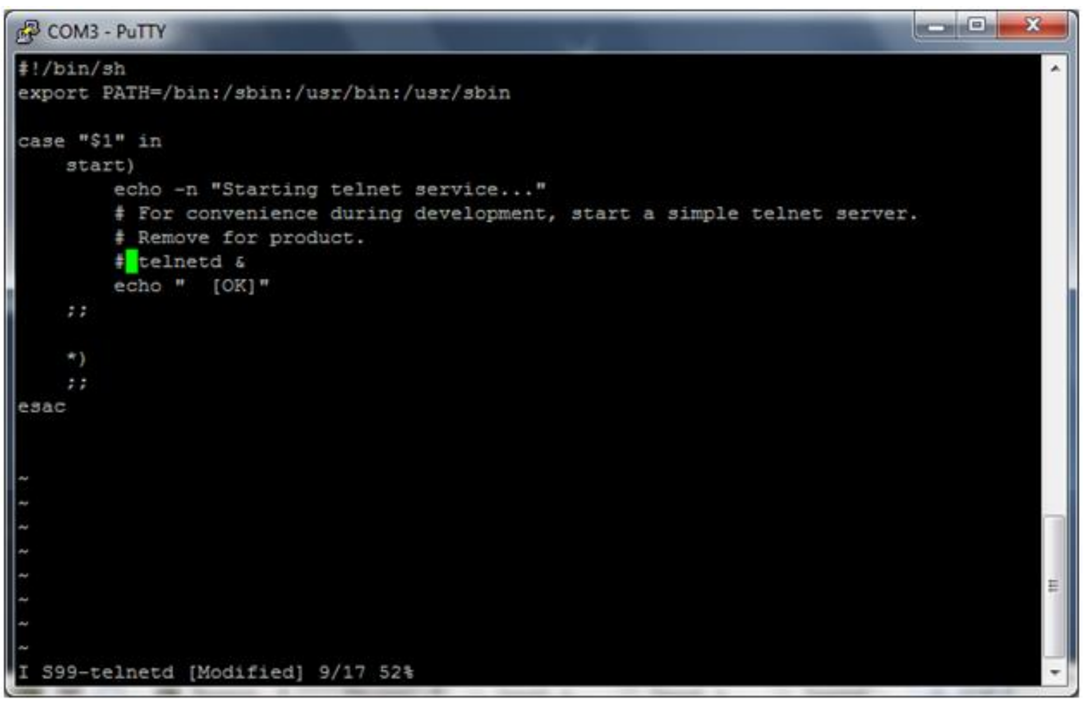
To disable the Telnet port

1 Change to the `s99-telnetd` directory. Type:
`cd\etc\init.d\S99-telnetd`

2 List the files in the directory. Type:
`ls`



3 Comment out the `telnetd` file.

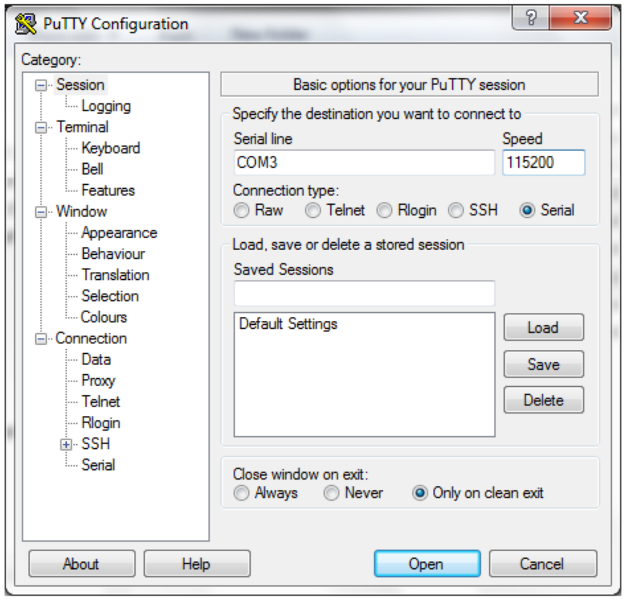


4 To enable the port, simply un-comment the same line.

1.6.3 Enabling and Disabling the Console Port

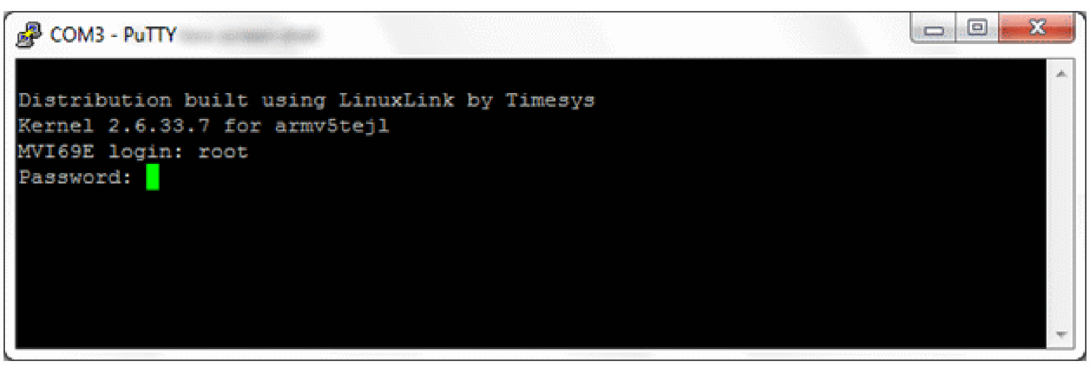
Establish a connection to the module. This example uses PuTTY.

1 Open PuTTY.

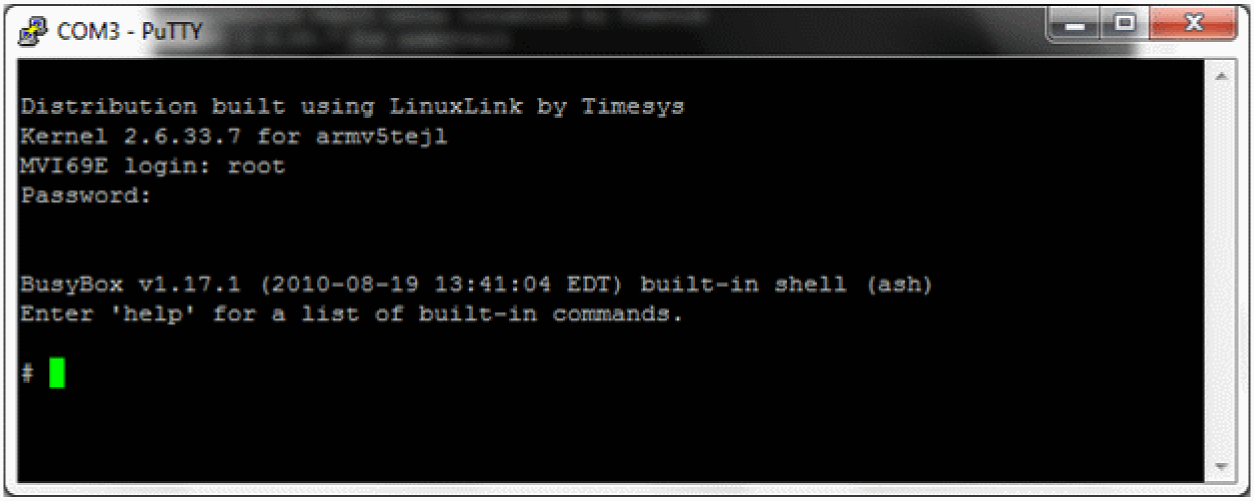


2 Set **SPEED** to 115200.
3 Set the **SERIAL LINE** to the appropriate COM port.
4 Ensure that the **CONNECTION TYPE** is Serial.
5 Click **OPEN**. The PuTTY session opens.
6 Enter your login and password.
MVI69E login: `root`
Password: `password`

> **Note:** After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

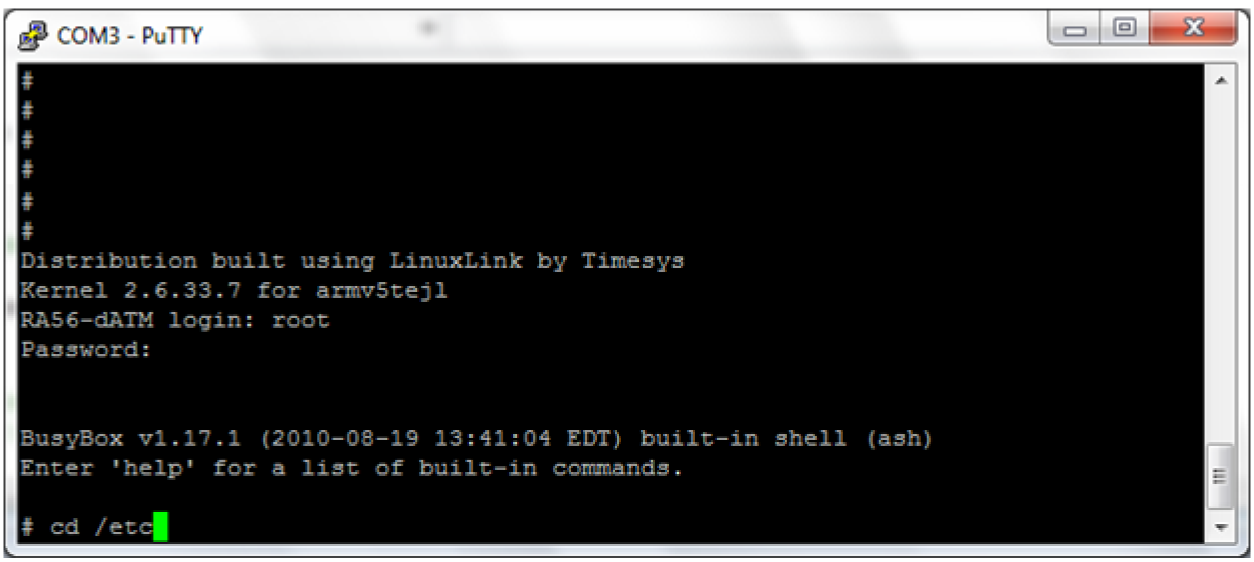


The following text appears:

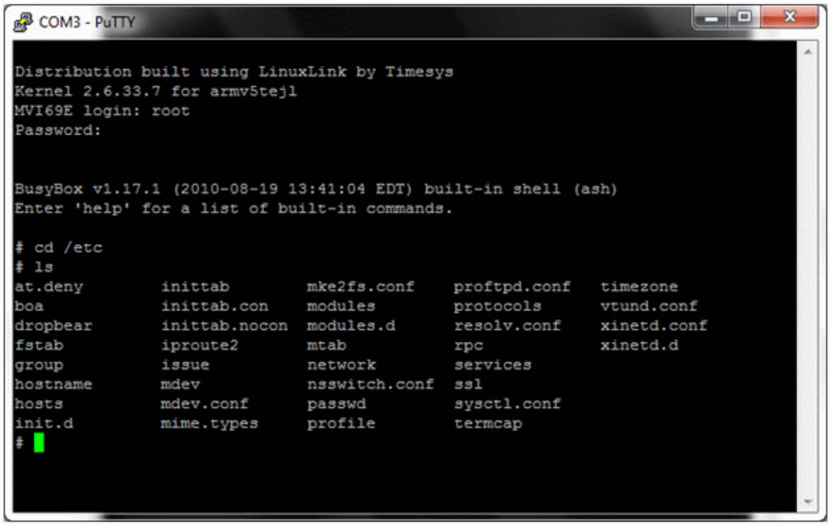


7 Change to the `/etc` directory. Type:

```
cd /etc
```

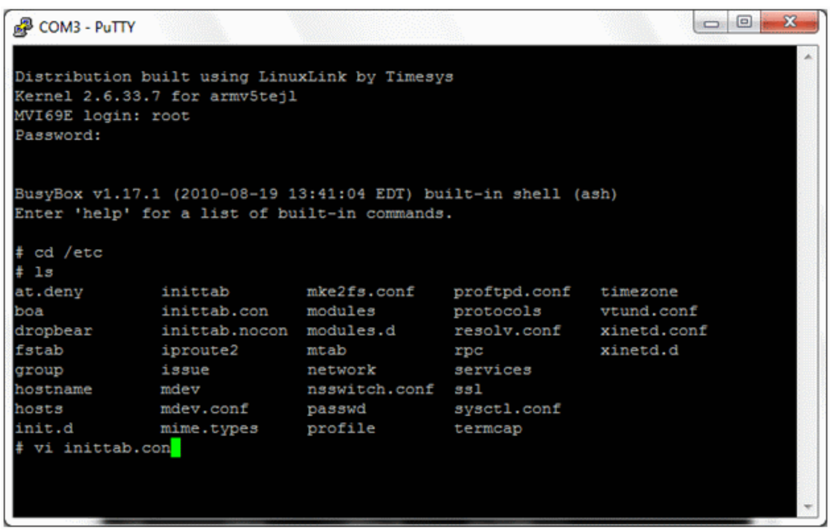


8 Type `ls`. The following appears:

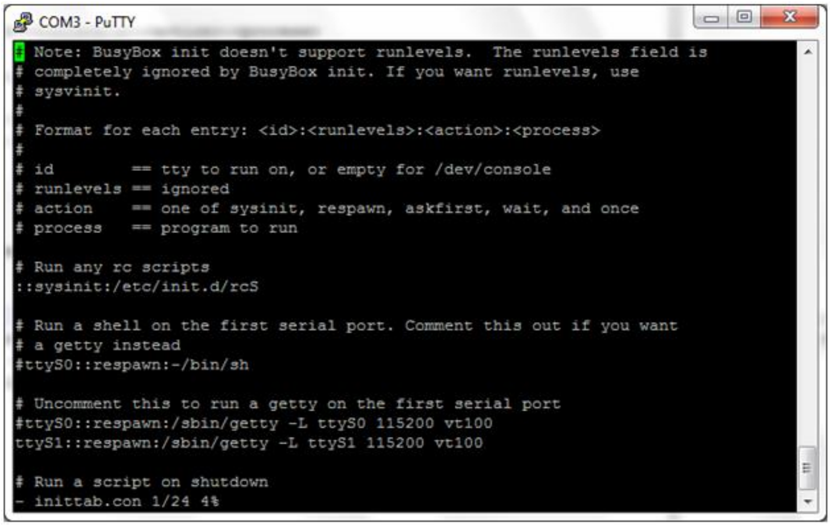


<u>To enable the console port:</u>

The **inittab.con** file configures the console.



1 Open the file in the vi editor. Type
`vi inittab.con`



```
COM3 - PuTTY
# Note: BusyBox init doesn't support runlevels.  The runlevels field is
# completely ignored by BusyBox init. If you want runlevels, use
# sysvinit.
#
# Format for each entry: <id>:<runlevels>:<action>:<process>
#
# id        == tty to run on, or empty for /dev/console
# runlevels == ignored
# action    == one of sysinit, respawn, askfirst, wait, and once
# process   == program to run

# Run any rc scripts
::sysinit:/etc/init.d/rcS

# Run a shell on the first serial port. Comment this out if you want
# a getty instead
#ttyS0::respawn:-/bin/sh

# Uncomment this to run a getty on the first serial port
#ttyS0::respawn:/sbin/getty -L ttyS0 115200 vt100
ttyS1::respawn:/sbin/getty -L ttyS1 115200 vt100

# Run a script on shutdown
- inittab.con 1/24 4%
```

2 Copy `inittab.con` file to the `inittab` file. Type
`cp -f inittab.con inittab`

3 Save the file and reboot the module.

<u>To disable the console:</u>

1 Copy `inittab.nocon` file to the `inittab` file.

2 Save the file and reboot the module.

1.7 Establishing Module Communications

Ensure that the module is firmly seated in the rack and that the cables connected to the module are secure. Ensure that power is applied.

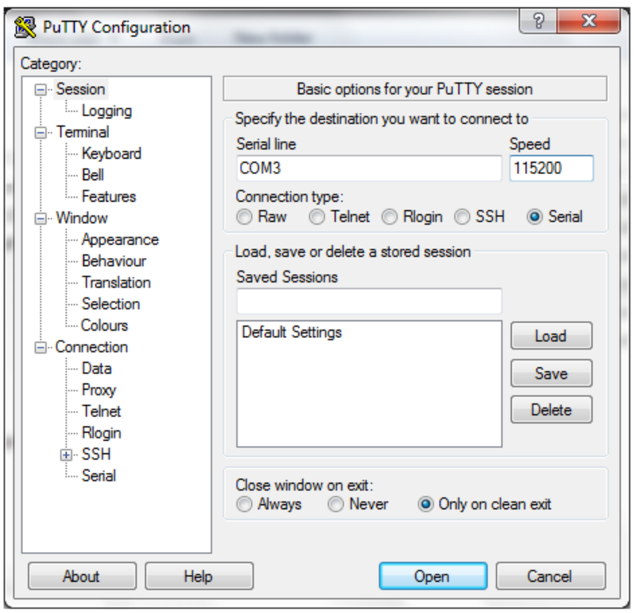
> **Note:** If you require information on cables and port pinouts, please refer to the section entitled *Cable Connections* (page 92) at the end of the document.

RS-232 Console

If you are connected to Serial Port 1 (P1), establish communications with the module using the following procedure.

> **Note:** The following procedure uses PuTTY to establish communications. You can use a different communication program.

1 Open PuTTY.



2 Set **SPEED** to 115200.
3 Set **SERIAL LINE** to the appropriate COM port.
4 Ensure that **CONNECTION TYPE** is set to Serial.
5 Click **OPEN** to open the PuTTY session.
6 Enter your login and password:
MVI69E login: `root`
Password: `password`

> **Note:** After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

Ethernet (Telnet)

You can communicate with the module through Ethernet Port 1 (Eth 1) using Telnet.

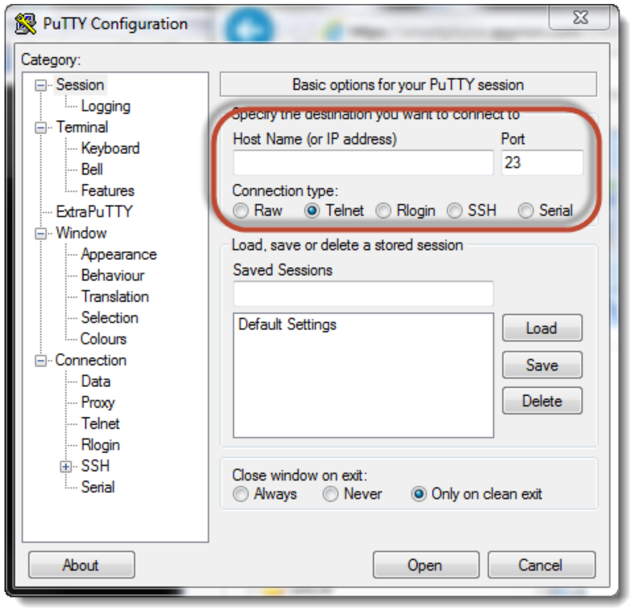
The Ethernet Port (Eth 1) on the module is programmed with eth0 set to IP 192.168.0.250 and a Subnet Mask of 255.255.255.0. In order for your PC or laptop to talk to the module, your PC or Laptop must be on the same subnet as the module. This means that you must temporarily change the IP address and subnet mask on your PC or laptop to match that of the module. You can then change the module's IP address to match your needs. Follow these steps or see http://windows.microsoft.com/en-us/windows/change-tcp-ip-settings#1TC=windows-7 http://windows.microsoft.com/en-us/windows/change-tcp-ip-settings#1TC=windows-7.

1 Change the IP address of your PC or Laptop so it matches the subnet of the module. The following steps are for Windows 7.

- **a** Change your IP address through the router. Consult your router documentation for more information.
- **b** Change your IP address through Windows Network Connections. Click **START** > **CONTROL PANEL** > **NETWORK AND SHARING CENTER**.
- **c** Click the **CONNECTION** link for the connection you want to change and choose **PROPERTIES**.
- **d** On the Local Area Connection Properties dialog, select the connection you want to change (Internet Protocol Version 6 or Internet Protocol Version 4), and then click **PROPERTIES**.
- **e** In the Internet Protocol Version 4 or 6 Properties dialog, click **USE THE FOLLOWING IP ADDRESS**.
- **f** Type in the IP address settings for the **IP ADDRESS**, **SUBNET MASK**, and **DEFAULT GATEWAY**.
- **g** Click **OK** to accept the changes and then close each of the dialog boxes.

2 Ensure that an Ethernet cable is connected to Ethernet Port 1 (Eth 1) of the module, and the other end to the same Ethernet switch as your PC.

3 Use a program such as PuTTY to Telnet into the module.



4 Select Telnet as the **CONNECTION TYPE**.
5 Enter the **IP ADDRESS** (192.168.0.250).
6 Port 23 should appear as the **PORT** number.
7 Click **OPEN** to establish a connection.
8 Log into the module.

There are two methods you can use to change the module's IP address. One is temporary for use in cases where you want to change the address long enough to make a quick change. The other is more permanent so that the module is already programmed and is ready for full deployment.

Temporary IP Address Change

At the Linux prompt, type:
`ifconfig eth0 x.x.x.x` (This changes the IP address of the Ethernet Eth 1 port.)

Permanent IP Address Change

1 At the Linux prompt, change to the /etc/network directory. Type:
```
cd ../etc/network
```
2 Open the `interfaces` file int he vi editor. Type:
```
vi interfaces
```
This shows the contents of the file:
```
iface eth0 inet static
    address 192.168.0.250
    network 192.168.0.0
    netmask 255.255.255.0
    broadcast 192.168.0.255
#   gateway 192.168.0.1
```

3 Using the vi editor, edit the file to change the address.
4 Save the file.

For help on using the vi editor to write and save the file, refer to http://www.lagmonster.org/docs/vi.html

5 Change the IP address of your PC back to the original IP address and subnet.
6 Telnet to the new IP Address of the module.

1.8 Resetting the Module

In the event that it becomes necessary to revert the MVI69E-LDM module back to its initial out-of-the-box state, there are a number of methods you can use depending on the condition of the module.

The Rescue process re-installs all of the Operation System commands and configurations to their original defaults. The files deleted during the rescue process are the startup scripts in the /etc/init.d path since extra scripts in this path are automatically executed by the operating system on startup and may cause problems. All other files may be overwritten to the initial state of the device. Extra files are not deleted.

If the web pages and services for the module have been altered, it may not be possible to use the web-based rescue.

To connect to the module over Ethernet:

1 Place the onboard setup jumper to the installed state. See *Setup Jumper - MVI69E.*
2 If you know the the IP address, change the network mask and IP of the connected PC to compatible values.

For example, if the MVI69E-LDM is configured with the default IP address (192.168.0.250) and network mask (255.255.255.0), the the PC should have the same IP4 network mask and an IP address in the 192.168.0.xxx subnet.
Note that IP addresses must be unique on the network. If in doubt, create a physical network consisting of only the MVI69E-LDM and the PC.

If you do not know the IP address of the MVI69E-LDM module, you can establish communication through the serial configuration port, Port 1 (upper port).

1 Use Telnet or a similar terminal program to communicate with the module. The default settings are 115,200 baud, 8 data bits,1 stop bit, No Parity, xon/xoff flow control.
2 Use the following username and password:
Username: `root`
Password: `password`

Note: After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

3 From the shell prompt, run `ifconfig` to find the Ethernet IP address and network mask of device "eth0". Then follow the steps under *To connect to the module over Ethernet* (above).

To use web-based rescue:

The web page for the MVI69E-LDM module contains a command on the left side of the page to reset the module.

1. Open the web page for the module by entering the IP address of the module in the address bar. If necessary, set your PC to an IP address and the same sub-network. See To connect to the module over Ethernet (above).
2. On the left-side of the page, under **FUNCTIONS**, click **RESCUE MODULE**. Follow the instructions to reset the module to its default state.

> **Note:** Most loaded components are left intact by this operation so it may be necessary to make enough room on the module for the rescue to work. In addition, the Setup Jumper must be in place for the rescue to function properly.

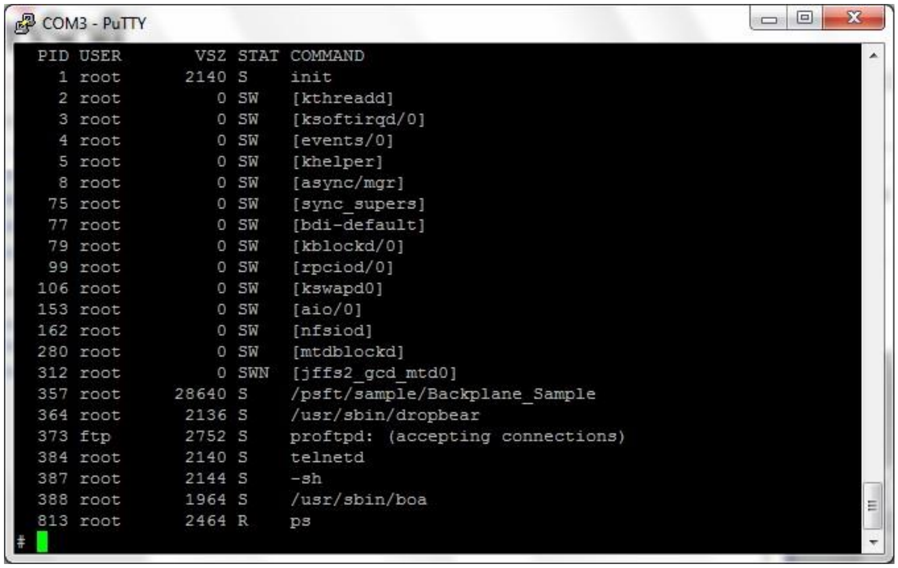
To use manual rescue:

If the default web page is unavailable, a manual rescue may be required. Perform the following steps to manually return the module to its default state:

1. Establish a terminal session to the module using either the Serial or Ethernet port.
2. Ensure that the `/backup/systemrestore.tgz` file exists.
3. Run the following command to remove any startup scripts that may be interfering with the bootup process:
   ```
   rm -f /etc/init.d/*
   ```
4. Restore the configuration and executables using the following command:
   ```
   tar -xzf /backup/systemrestore.tgz -C /
   ```
5. If successful, reboot the module.

1.9 Important Information Before Development

When the MVI69E-LDM is initially installed in the backplane, the module runs a number of programs that are required in order not to fault the processor.

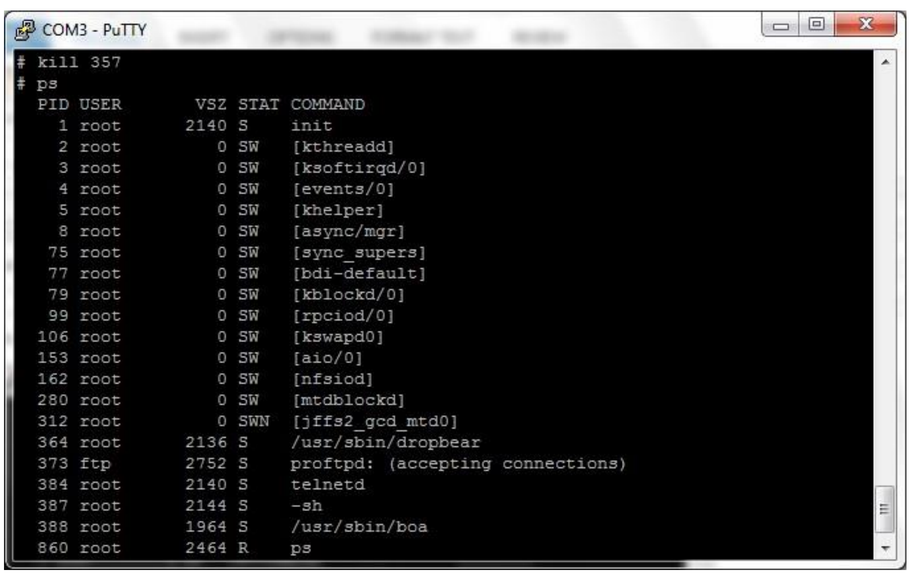


```
  PID USER       VSZ STAT COMMAND
    1 root      2140 S    init
    2 root         0 SW   [kthreadd]
    3 root         0 SW   [ksoftirqd/0]
    4 root         0 SW   [events/0]
    5 root         0 SW   [khelper]
    8 root         0 SW   [async/mgr]
   75 root         0 SW   [sync_supers]
   77 root         0 SW   [bdi-default]
   79 root         0 SW   [kblockd/0]
   99 root         0 SW   [rpciod/0]
  106 root         0 SW   [kswapd0]
  153 root         0 SW   [aio/0]
  162 root         0 SW   [nfsiod]
  280 root         0 SW   [mtdblockd]
  312 root         0 SWN  [jffs2_gcd_mtd0]
  357 root     28640 S    /psft/sample/Backplane_Sample
  364 root      2136 S    /usr/sbin/dropbear
  373 ftp       2752 S    proftpd: (accepting connections)
  384 root      2140 S    telnetd
  387 root      2144 S    -sh
  388 root      1964 S    /usr/sbin/boa
  813 root      2464 R    ps
#
```

Line 357, **/psft/sample/Backplane_Sample** runs for the purpose of not faulting the processor. The module also contains a number of sample applications that will not run if backplane sample is also running. The samples affected are **enet_application** and **serial_application**.

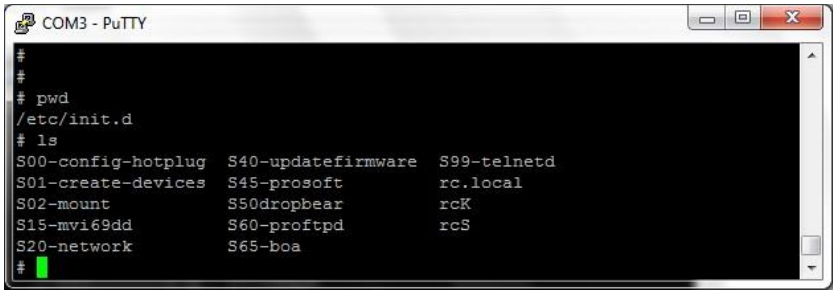
You can kill the Backplane_Sample script by typing:

```
kill 357
```

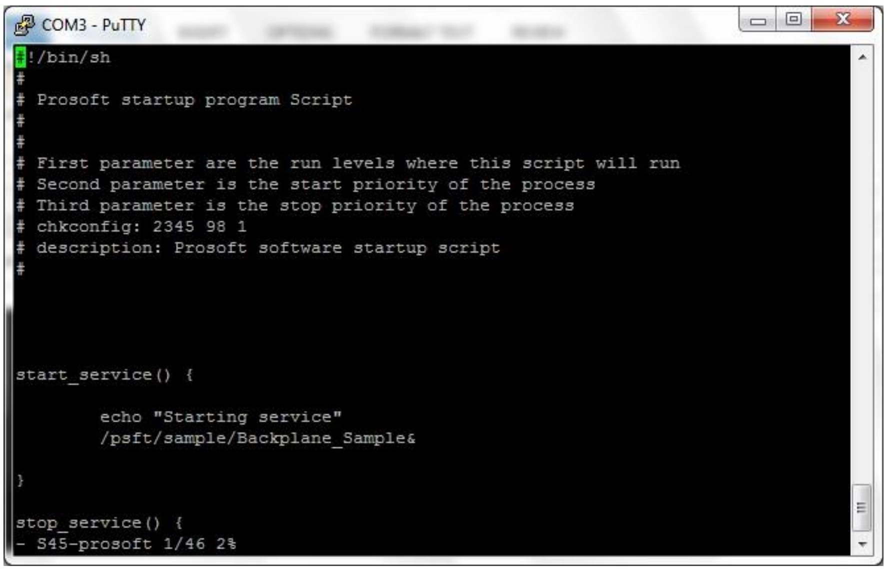


```
# kill 357
# ps
  PID USER       VSZ STAT COMMAND
    1 root      2140 S    init
    2 root         0 SW   [kthreadd]
    3 root         0 SW   [ksoftirqd/0]
    4 root         0 SW   [events/0]
    5 root         0 SW   [khelper]
    8 root         0 SW   [async/mgr]
   75 root         0 SW   [sync_supers]
   77 root         0 SW   [bdi-default]
   79 root         0 SW   [kblockd/0]
   99 root         0 SW   [rpciod/0]
  106 root         0 SW   [kswapd0]
  153 root         0 SW   [aio/0]
  162 root         0 SW   [nfsiod]
  280 root         0 SW   [mtdblockd]
  312 root         0 SWN  [jffs2_gcd_mtd0]
  364 root      2136 S    /usr/sbin/dropbear
  373 ftp       2752 S    proftpd: (accepting connections)
  384 root      2140 S    telnetd
  387 root      2144 S    -sh
  388 root      1964 S    /usr/sbin/boa
  860 root      2464 R    ps
```

You can modify the **Backplane_Sample** script from this location:



The script that you want to modify is **S45-prosoft**.



You can see from this script that the **Backplane_Sample** is configured to run at startup. Change this to suit your needs**.**

2 Development Environment

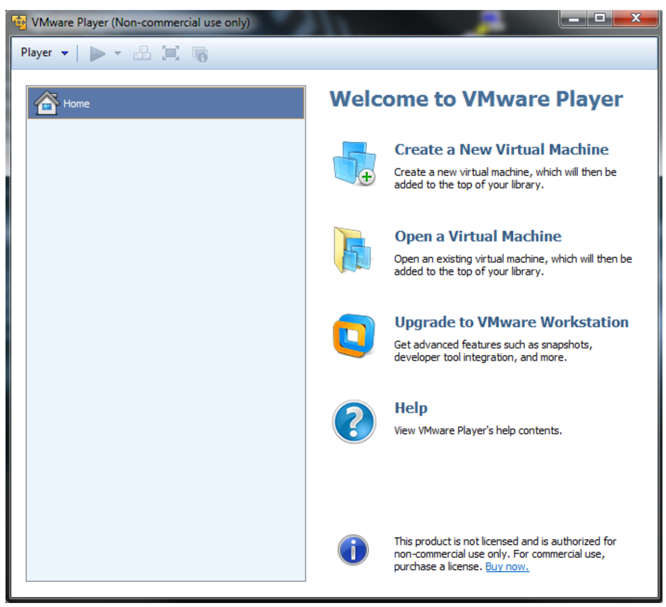
The MVI69E-LDM development tools run under Linux. In order to run these tools on a Windows-based machine, you must run a Virtual Machine that hosts the Linux Operating System.

VMware provides a virtual machine player used to host the Linux Operating System. You can find it at: https://my.vmware.com/web/vmware/downloads

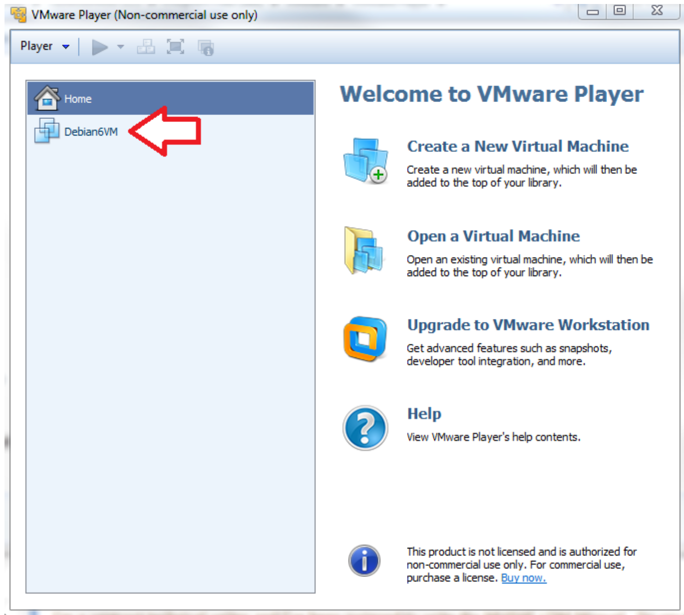
2.1 Setup

The file `Debian6VM.zip` is part of the LDMdevKit package which you can download for free from the ProSoft Technology website: www.prosoft-technology.com. You can also purchase the DVD (part number LDMdevKit) from ProSoft Technology.

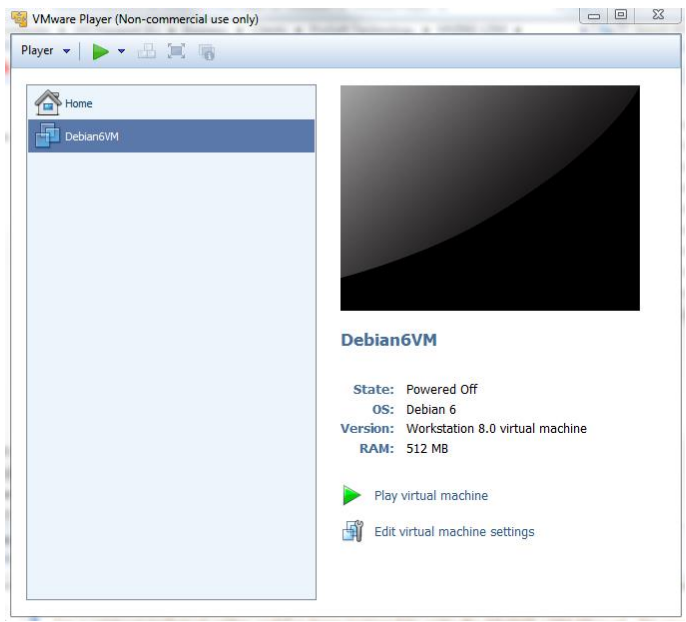
1 Copy the `Debian6VM.zip` file to your PC in the VM Player image ico directory (`VMware\VMware Player\ico`).
2 Uncompress `Debian6VM.zip` into this directory.
3 Start the VM Player by double-clicking on its icon on the Windows desktop.
4 Click **OPEN A VIRTUAL MACHINE**.



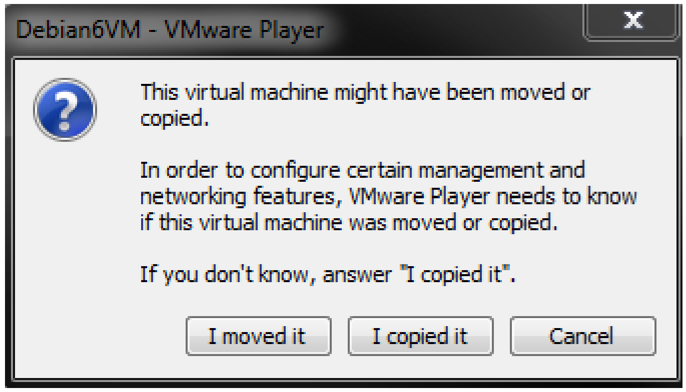
5 Navigate to the ico directory containing the Debian6VM file and click **DEBIAN6VM.VMX**. The image file icon appears in the left window.



The following screen appears:



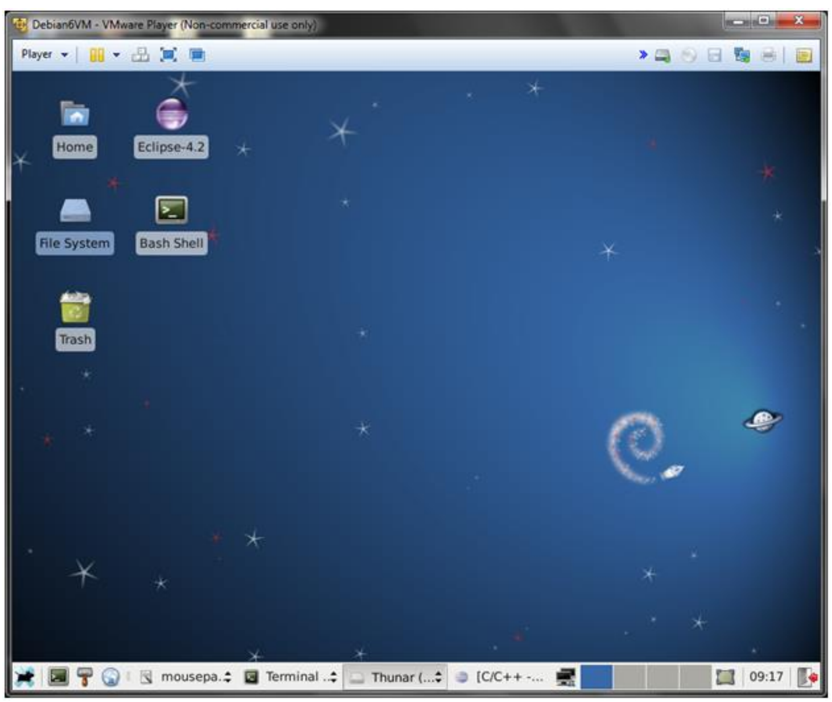
6 Click **PLAY VIRTUAL MACHINE**. A dialog appears asking if the virtual machine has been moved or copied. Click **I COPIED IT**.



7 After the image loads, the VMware Player prompts you for a username and password.
Username: `user`
Password: `password`

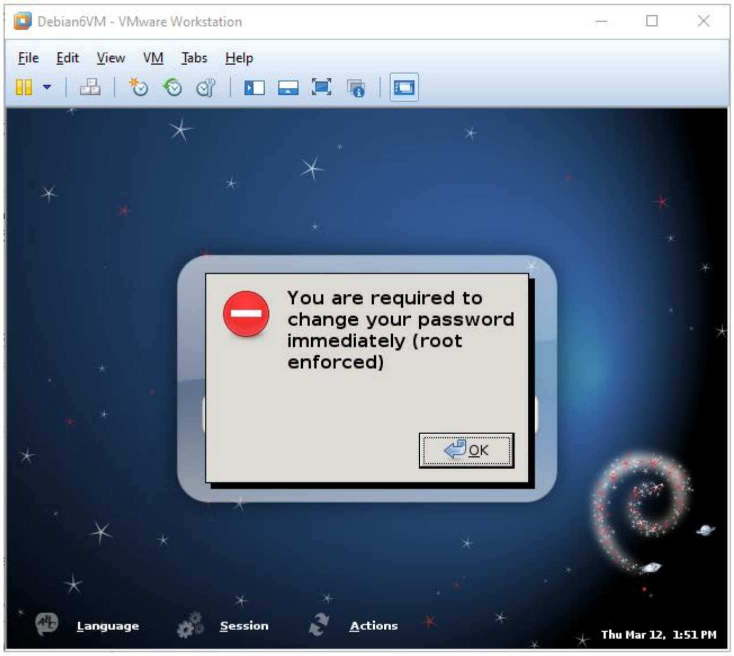
Note: After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference. Please see the next section Changing Password on page 33.

The home screen appears.

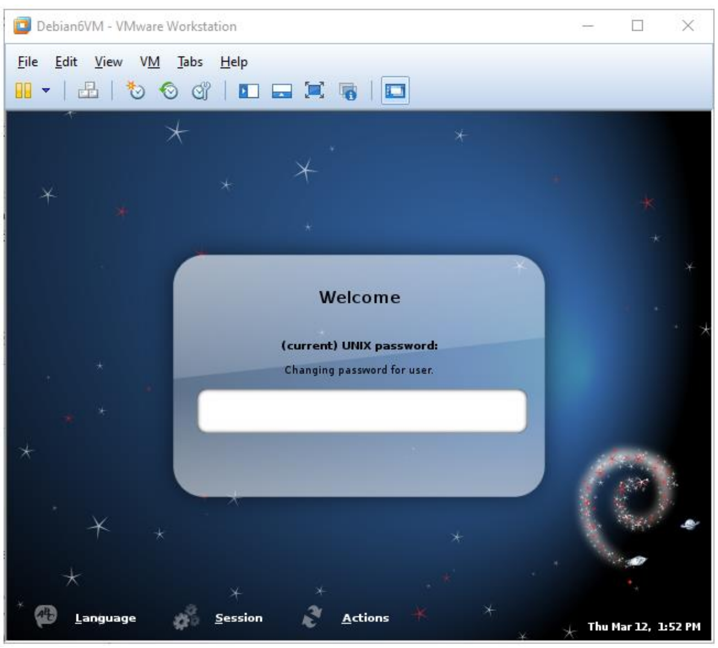


2.2 Changing Password

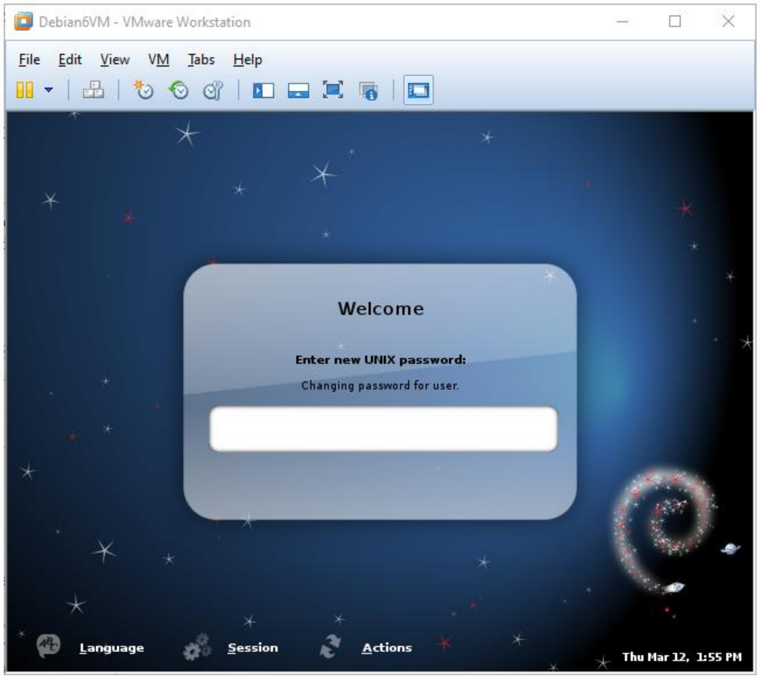
After the initial login to the VM, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.



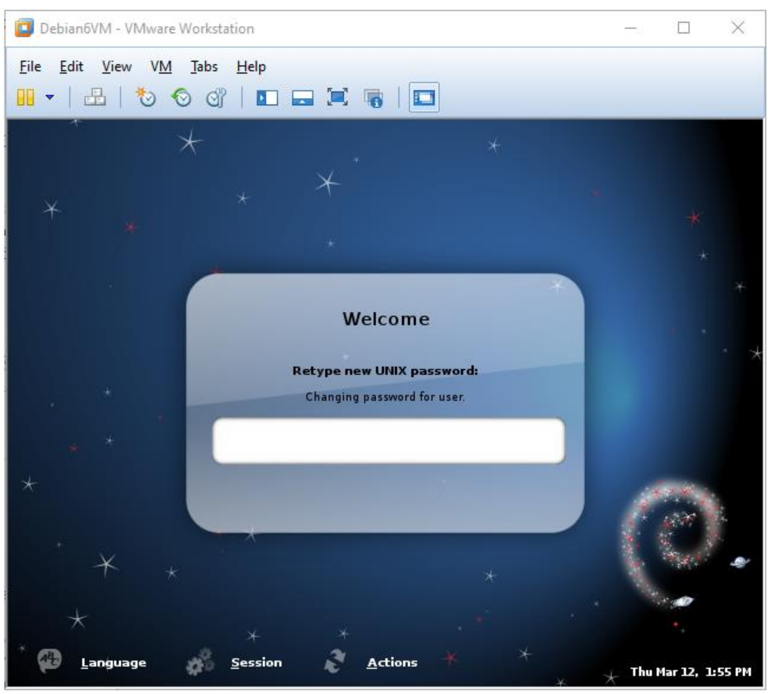
1 Enter the current (default) password: **password**.



2 Enter the new password.



3 Confirm the new password.

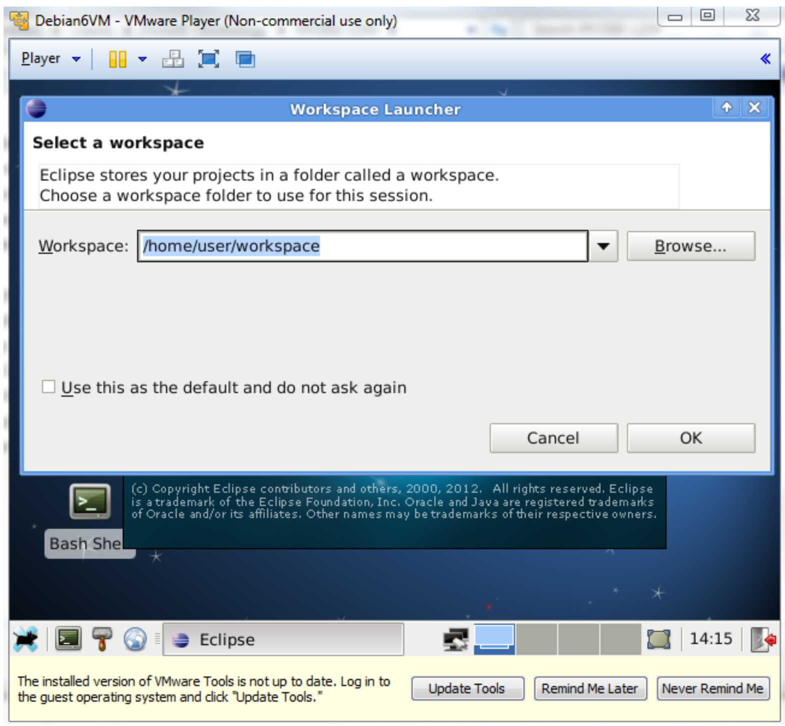


2.3 Starting Eclipse

Eclipse is an Integrated Development Environment (IDE) used in the Linux environment primarily to edit source code. Full documentation and downloads are available at: www.eclipse.org

To start Eclipse:

1 Double-click the Eclipse icon on our Windows desktop.
2 When the Workspace Launcher appears, choose the default workspace (/home/user/workspace).



3 Click **OK**.

The default workspace is pre-populated with sample programs, makefiles, and scripts. Building one of the sample projects is the recommended way to become familiar with the environment and the build process.

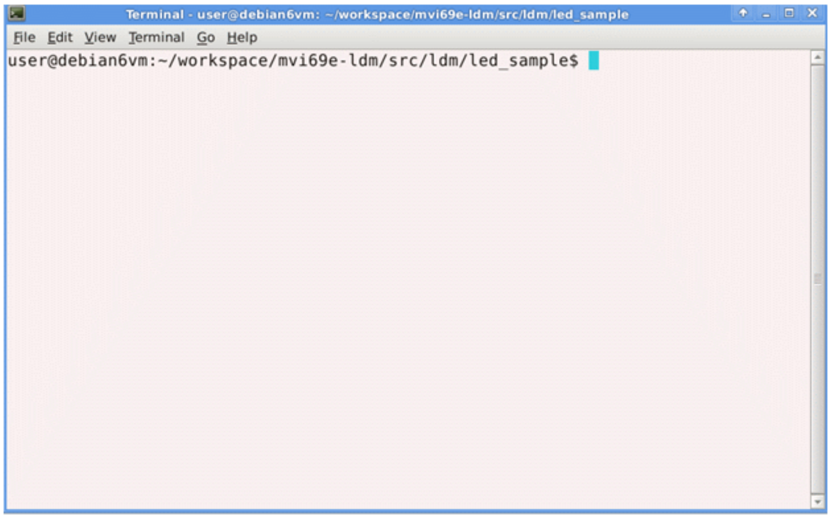
2.3.1 Building a Project

Building and using a sample application consists of the following steps:

1 Compiling and linking your application.
2 Downloading the application. There are two ways you can do this:
- Use FTP transfer to download the application.
- Create a downloadable image, and then download the image to the target device (module).

2.3.2 Compiling and Linking

1. Start the Linux (Debian) virtual machine in the VM Player.
2. Open a Bash Shell window by clicking on the **BASH SHELL** icon on the main page.
3. Once in the shell, change the directory to one of the samples. In this case, change the directory to get to the LED_sample program. Type:
   `cd /workspace/mvi69e-ldm/src/LDM/led_sample$`



4. To recompile and link, simply type:
   `make`

   In this case, the executable is up to date and nothing needs to be done.
5. If the source is changed, the make utility detects the newer time on the source file and rebuilds the application. The following example uses the Touch utility to cause the date of a file (`led_sample.c`) to be updated as if the file had been changed, and make is re-invoked. Make detects this change, recompiles and re-links the application.

2.3.3 Downloading the Application with FTP

To transfer the application using FTP Transfer, use any FTP transfer program such as FileZilla (https://filezilla-project.org/) from the Windows environment.

Use FileZilla to connect to the target by specifying the IP address of the MVI69E-LDM's IP.

Download the application image to the desired directory on the LDM using the FTP transfer program.

Since Windows does not have the same detailed permissions as Linux, you must change the file permissions on the application once in the module. Use the command `chmod a+x filename` to add the execute attribute to the application.

You can also download the application by creating an image and using Firmware update. See *Creating an Application Image*.

2.3.4 Creating an Application Image

An image contains all of the application-specific components required for your application. This includes the executable(s), application-specific shared libraries, scripts, web pages, and data files. It does not contain the operating system or common components that are already on the target device.

The image is a compressed tar file of the application components. Once created, use the device's web page to download the firmware upgrade. The tar file name is specified in **IMAGE CONTENTS**. In the sample image, the firmware file is 'firmware/mvi69e-ldm.firmware *revision date*'. This firmware file is downloaded to the directory `/psfttmp` on the target device. Upon system restart, the system startup scripts unpack the tar file into the **psfttmp** directory. The script `/psfttmp/install` is executed to move the component files into their final destination.

A sample install file is included with the sample applications. The steps are:

1 Create all of the components that are part of the system. This mainly involves compiling and linking executables and shared libraries.
2 Create the install script.
3 Modify any web pages and data files that will be needed.
4 Last, update the install script.

<u>To create the Image Contents:</u>

Each component file to be included in the image is listed in the file `imagecontents` in the build directory structure for the specific application. This file contains header information about the image and a list of entries describing the files to be added to the image. The format of the entry is:
Add source destination file permissions

Where:

- The source file is the path to the file to be included.
- The destination file is the full path name of the file on the destination on the target device.
- The permissions are the Linux style permissions of the file on the destination.

For example, a line to add the LED_Sample application looks like:

```
Add ../../src/ldm/led_sample/Release/Led_Sample /psft/sample/Led_Sample rwxrwxr-x
```

Since builds occur in `/home/usr/workspace/mvi69e-ldm/build/LDM`, source paths are relative to this directory to simplify moving to a new directory.

Follow the sample provided to create a complete image contents file.

To create the Install Script:

Before creating the image, you must create and add an install script to the firmware package. As noted above, the firmware package is downloaded into the `/psfttmp` directory on the device. The install script copies the files in `/psfttmp` to their final destination on the target device. You can use the install script to make backups of the current directory contents before they are overwritten. The LDM sample install script in build/LDM/scripts illustrates how to do this.

To create the Image:

1 In a Linux shell, change the directory to the ...build/LDM directory.

2 Run python with the following command:
```
python createimage.py
```

The python script `createimage.py` reads and acts on the `imagecontents` file and then creates a new firmware image in the directory `.../build/LDM/firmware`.

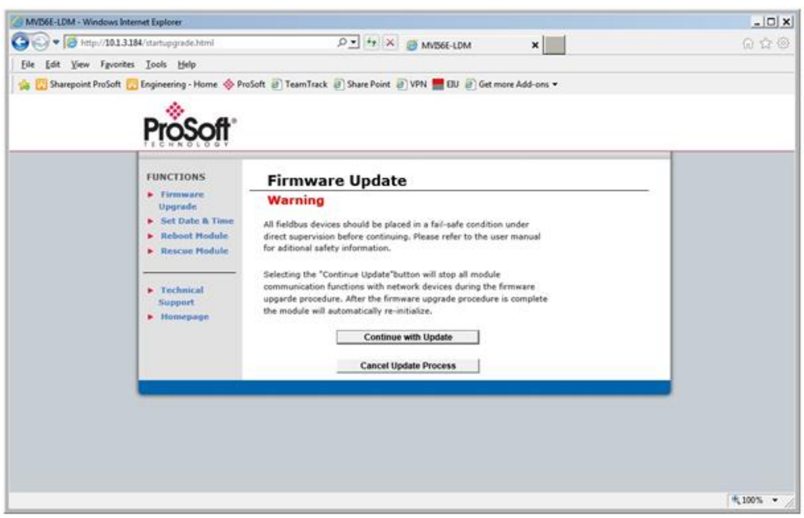
Note: The script `build.sh` compiles and links all libs and executables and then invoke python to create the firmware image.

2.3.5 Downloading the Image with Firmware Update

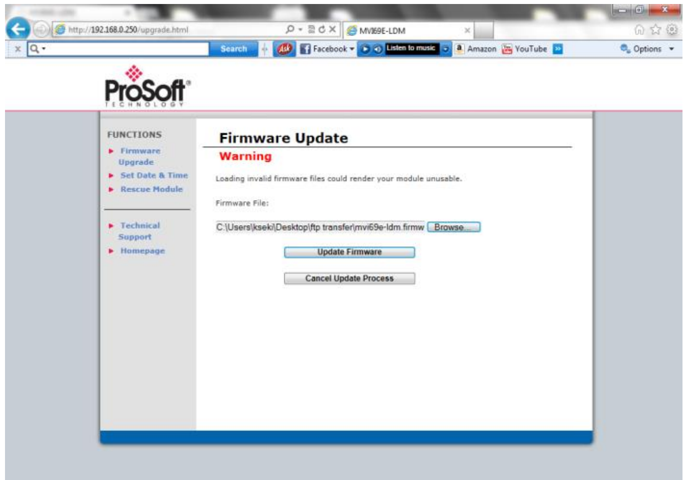
1 Ensure that the Setup Jumper is on. See *Setup Jumper* in this document.

2 Navigate to the module homepage using a Web browser by entering the module's IP address.

3 Click **FIRMWARE UPGRADE**. The Update page opens.



4 Click **CONTINUE WITH UPDATE**, and select the firmware file to be downloaded.



5 Click **UPDATE FIRMWARE** and wait for the module to reboot. During rebooting, the module expands the compressed file and runs the install script to move the component files to their final destination.

Note: The IP address reverts to the default after rebooting. This is a very common problem, so remember to reset the IP address to the correct value. See *Establishing Module Communication*.

3 Understanding the MVI69E-LDM API

The MVI69E LDM CPI API Suite allows software developers to access the CompactLogix backplane without requiring detailed knowledge of the module's hardware design. The MVI69E-LDM API Suite consists of three distinct components; the backplane device driver, the backplane interface engine, and the API library.

You can develop applications for the MVI69E-LDM module using industry-standard Linux programming tools and the CPI API library. This section provides general information pertaining to application development for the MVI69E-LDM module.

3.1 API Library

The API provides a library of function calls. The library supports any programming language that is compatible with the 'C' calling convention. The API library is a dynamic linked library that must be linked with the application to create the executable program>

Note: The following compiler versions are tested and known to be compatible with the MVI69E module API:
CNU C/C++ V4.4.4 for ARM9

3.1.1 Header File

A header file is provided along with the API library. This header file contains API function declarations, data structure definitions, and constant definitions. The header file is in standard 'C' format. Header files for the CIP API are `ocxbpapi.h` and `ocxtagdb.h`.

3.1.2 Sample Code

The sample applications illustrate the usage of the API functions. Full source for the sample application is included, along with make files to build the sample programs.

3.1.3 CompactLogix Tag Naming Conventions

CompactLogix tags fall into two categories; controller tags and program tags.

Controller Tags have global scope. To access a controller scope tag, you only need to specify the tag controller name. For example:

TagName	Single tag
Array[11]	Single dimensioned array element
Array[1,3]	Two dimensional array element
Array[1, 2, 3]	Three dimensional array element
Structure.Element	Structure element
StructureArray[1].Element	Single element of an array of structures

Program Tags are tags declared in a program and scoped only within the program in which they are declared. To correctly address a Program Tag, you must specify the identifier "PROGRAM:" followed by the program name. A dot (.) separates the program name and the tag name.

PROGRAM:ProgramName.TagName

PROGRAM:MainProgram.TagName	Tag "TagName in program called "MainProgram"
PROGRAM:MainProgram.Array[11]	An array element in program "MainProgram"
PROGRAM:MainProgram.Structure.Element	A Structure Element in program "MainProgram"

Rules

- A tag name can contain up to 40 characters.
- A tag name must start with a letter or underscore ("_"). All other characters can be letters, numbers or underscores.
- Names cannot contain two contiguous underscore characters and cannot end in with an underscore.
- Letter case is not significant.
- The naming conventions are based on the IEC-1131 Rules for Identifiers.

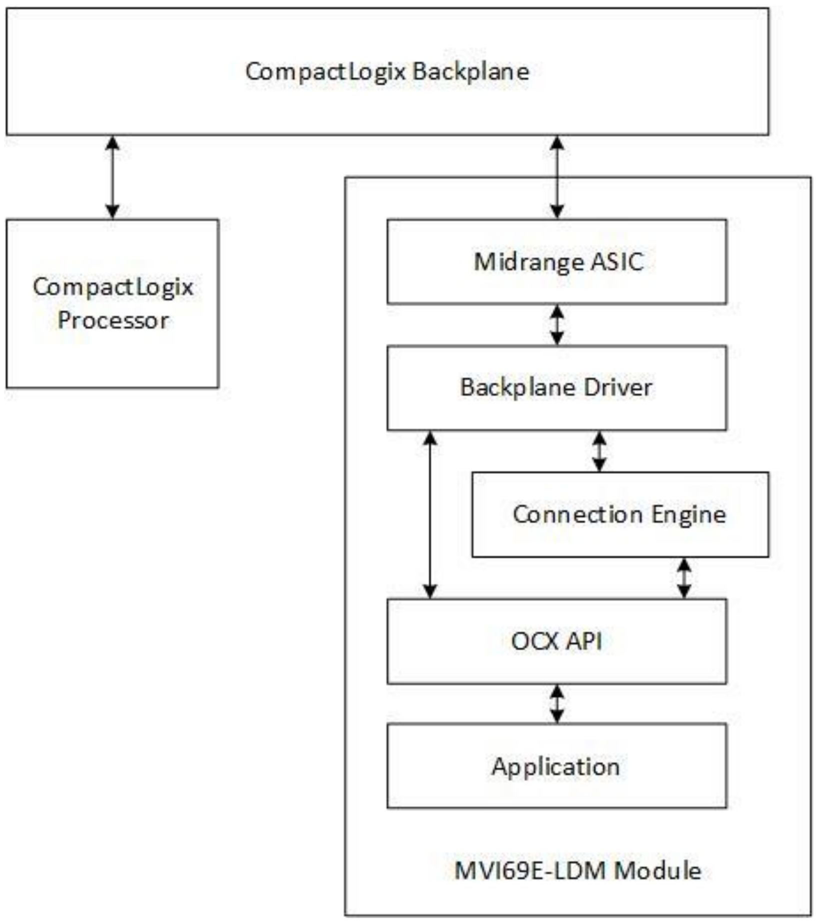
For additional information on CompactLogix CPU tag addressing, please refer to the CompactLogix User Manual.

3.2 MVI69E-LDM Development Tools

An application that is developed for the MVI69E-LDM module must be executed from the module's Flash ROM disk. Tools are provided with the API to build the disk image and download it to the module's Config/Debug port. See *Building a Project* (page 35).

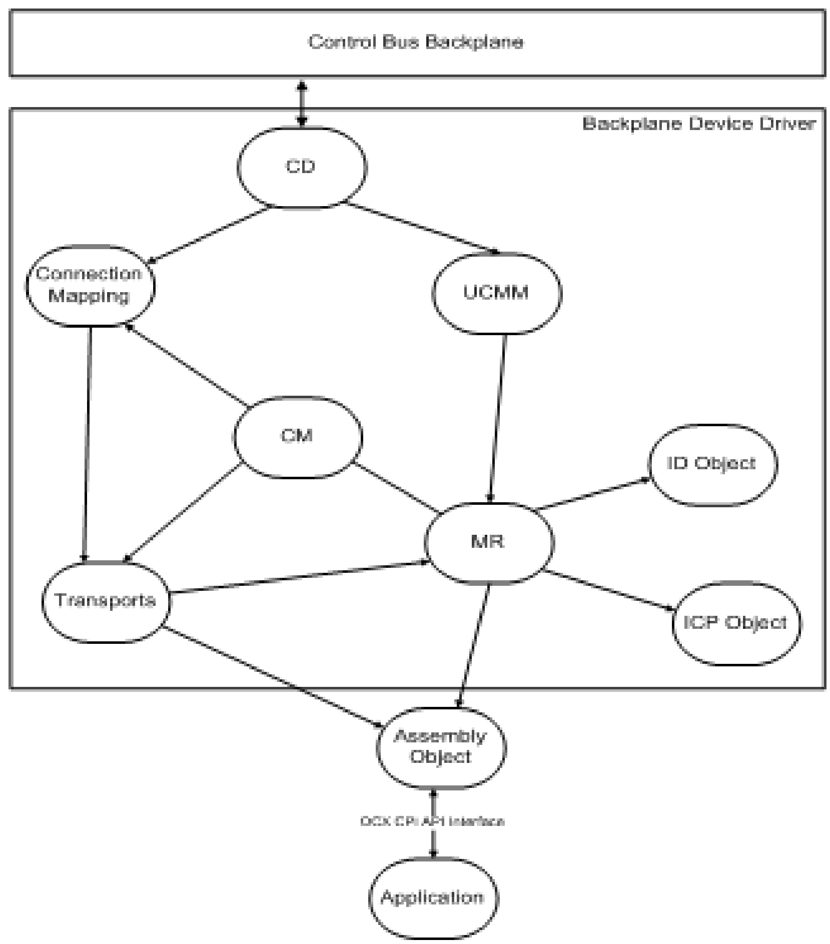
3.3 CIP API Architecture

The CIP API communicates with the CompactLogix modules through the backplane device driver. The following illustration shows the relationship between the module application, CIP API, and the backplane driver:



3.4 Backplane Device Driver

The backplane device driver performs CIP messaging over the CompactLogix backplane using the Midrange ASIC. The user application interfaces with the backplane device driver through the CIP API library. The backplane device driver for the MVI69E-LDM module is `libocxbpeng.so`. The driver implements the following components and objects:



All data exchange between the application and the backplane occurs through the Assembly Object, using functions provided by the CIP API. The API includes functions to register or unregister the object, accept or deny Class 1 schedule connections requests, access scheduled connection data, and service unscheduled messages.

4 Sample Code

To help understand the use of the MVI69E-LDM, several example programs are provided with the module. These programs exist as source code in the development environment as well as executable programs in the MVI69E-LDM in the `/psft/sample` directory.

You can build and download the sample programs to the MVI69E-LDM module. The sample programs are designed to show one or more sets of functionality.

LED Sample

- Opens the backplane
- Read and print module information
- Read and print version information
- Read and print module configuration jumpers
- Continuously change the state of the front panel LEDs

Backplane Sample

- Opens the backplane
- Set up communications with the PLC
- Read and display module information
- Read and write connected data with the CompactLogix processor

Server Ethernet Sample

- Opens the backplane
- Listens for a request on a well known port
- Responds with the date/time of the module

Client Ethernet Sample

- Opens the backplane
- Sends a request to another module; to the server Ethernet Sample
- Prints the response to the terminal

Serial Sample

- Opens the backplane
- Reads and modifies the serial configuration
- Transmits though the serial port

Install LDM

- Sets the module identity to ProSoft LDM
- Opens the backplane
- Read and print module information

4.1 Establishing a Console Connection

In order to run the Ethernet and Serial samples and tutorials, you must set up a connection in order to communicate with the MVI69E-LDM.

4.1.1 *Physically Connect to the Module*

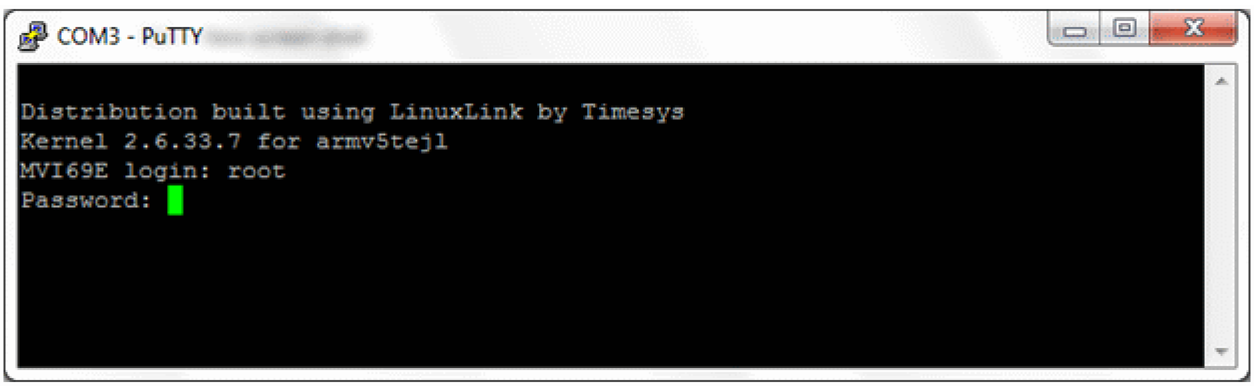
In order to establish a console session between a PC and the MVI69E-LDM, you must physically connect your PC to the console serial port on the module.

1. Plug in an RJ45 to DB9 cable on the module's Port 1.
2. Connect the null modem cable to the DB9 end of the RJ45 to DB9 cable.
3. Connect the other end of the null modem cable to the appropriate serial port (USB to Serial Converter) on the computer.

4.1.2 *Configuring Serial Communication*

1. Establish a connection to the module. The following example uses PUTTY. You can download PUTTY for free from:
   http://www.chiark.greenend.org.uk/~sgtatham/PuTTY/download.html
   http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html
2. MVI69E login: `root`
   Password: `password`

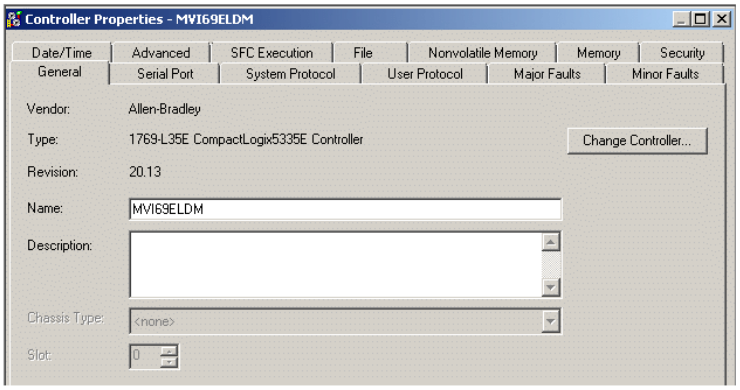
Note: After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.



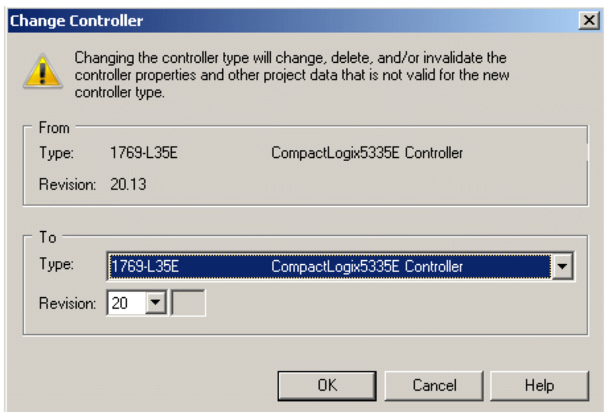
Keep PUTTY open while you set up CompactLogix as described in the next section.

4.1.3 Setting Up ControlLogix 5000

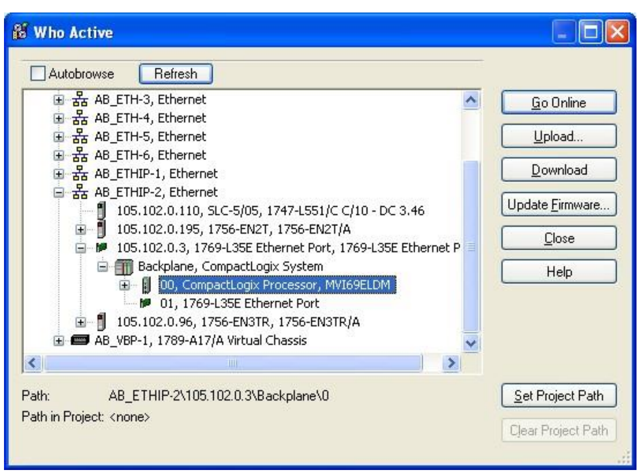
1 Open the MVI69E-LDM.ACD program and then click **CHANGE CONTROLLER** to change the appropriate chassis type to match your hardware and firmware.



2 Select the **TYPE** and **REVISION** of your Controller and click **OK** .



3 Download MVI69_LDM.ACD file in the CompactLogix processor by choosing **COMMUNICATIONS > WHO ACTIVE > DOWNLOAD.**



4.2 Sample Tutorials

The following sections describe how to run and understand the sample tutorials provided with the module. These samples handle the data exchange between the MVI69E-LDM and end device(s).

4.2.1 Ethernet Sample

The Ethernet sample comes as two programs; a client, and a server.

- The server waits for a client to request a connection, replies with the local time, and closes the connection.
- The client runs with the IP4 address of the server.
- The client opens a connection to the server, receives the response message, and prints the message (the time on the server) to the console.

It is recommended that you run the server on one MVI69E-LDM module and the client on another. Alternately, either of the programs could be ported to another Linux environment. Attempting to run both programs on the same MVI69E-LDM is not advised due to the complexity of IP routing.

Server ENet Sample

To run the Server ENet sample:

1 Establish a command window using Telnet or similar terminal software on the PC through the Serial P1 port.
2 Login as user: **root**, using password: **password**.

> **Note:** After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

3 The Ethernet Port E1 is used to communicate with the client device. The server and client devices must both be connected on the same IPv4 subnet.
4 Set the IPv4 address and mask of the Ethernet port using the `ifconfig` command.

To execute the sample:

1. Navigate to the default home directory `/psft/sample`.
2. Type the command `./Server_Sample&` to run the program as a background task. The server will wait forever processing requests from clients.

While reviewing the source code, you'll see that the program:

- registers `sigquit_handler` for four signals using the signal function.
- checks command line and prints usage message if needed.
- opens the backplane using `open_backplane()`. See the description in `Backplane_Sample`.
- initializes the LEDs on the front panel.
- Calls the function `socket()` to create an UN-named socket inside the kernel. `socket()` returns an integer known as a socket descriptor:
  - The function takes domain/family as its first argument. For Internet family of IPV4 addresses, use `AF_INET`.
  - The second argument `SOCK_STREAM` specifies that type of connection to use. In this case, a sequential, reliable, two way connection is desired.
  - The third argument select the protocol. Generally, this is zero as the system normally only has one protocol for each type of connection, although it is possible to have multiple protocols for a connection type. Zero tells the system to use the default protocol for the specified type of connection. In this case, the default is TCP.
- zeros out the `send buff` and `serv addr` variables.
- In preparation for the call to `bind()`, the `serv_addr` is then set to the well known port address `SERVER_PORT_NUMBER`, and any IP address. This allows a connection to be accepted from any IP address as long as the well known port address is specified.
- calls function `bind()` to assign the address specified in the structure `serv_addr` to the socket created by the call to `socket ()`.
- calls function `listen()` with second argument as '10' to specify the maximum number of client connections that the server will queue for this listening socket.
- The call to `listen()` makes the socket a functional listening socket.
- Code enters an infinite while loop in which:
  - the call to `accept()` puts the server to sleep, waiting for an incoming client request. When a request is received and the three way TCP handshake is complete, `accept()` wakes up and returns the socket descriptor representing the client socket.
  - `time()` is called to read the current system time.
  - `snprintf()` is used to put the time into the send buffer in a human readable format.
  - `write()` is then called to send formatted time to the client.
  - `close()` is then used to close the connection to the client.
  - `sleep()` is invoked to yield the processor for one second.

Client ENet Sample

To run the Client ENet Sample:

1 Establish a command window using Telnet or similar terminal software on the PC through the Serial P1 port.
2 Login as user: `root`, using password: `password`.

> **Note:** After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

3 The Ethernet Port E1 will be used to communicate with the server. The server and client devices must both be connected on the same IPv4 subnet.
4 Set the IPv4 address and mask of the first Ethernet port using `ifconfig` command.

To execute the sample:

1 Go to the default home directory `/psft/sample`.
2 Type the command `./Client_Sample` ip.address.of.server to run the program. The IP address of the server node must be provided in order for the server to know which node is executing the server program.
3 The client will send a connection request to the server, print the response from the server to the console, and then exit.

Reviewing the source code for `Client_Sample`, you will see that the main program:

- registers `sigquit_handler` for four signals.
- checks command line and print usage message if required.
- opens the backplane using `open_backplane()`. See the detailed description in `backplane_sample`.
- creates a socket with a call to `socket()`.
- initializes the server address (serv_addr) structure:
  - indicates that an IP4 address is going to be used with `AF_INET`.
  - sets the destination port is the well known port `SERVER_PORT_NUMBER`.
  - converts the string version of the server IP address to binary with `inet_pton()`.
- `connect()` is called to create the TCP connection to the server.
- When the sockets are connected, the server sends the date and time from the server as a message back to the clients. The client then uses the `read()` function to receive the buffer of data and prints the contents to the console.

4.2.2 Serial Sample

To run the Serial sample:

1 Establish a command window using Telnet or similar terminal software on the PC through the Ethernet E1 port or Serial P1 port.
2 Login:
user: `root`
password: `password`

Note: After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

To execute the sample:

1 Navigate to the default home directory `/psft/sample`.
2 Type the command `./Serial_Sample ttyS1 test string` in order to run the program with ttyS1 as the output, and "test string" sent to that port.

While reviewing the source code for `Serial_Sample`, you'll see that the main program:

- registers `sigquit_handler` for four signals.
- checks command line and print usage message if required.
- opens the backplane using `open_backplane()`. See the detailed description in `backplane_sample`.
- reads the serial configuration jumpers and ensures that both serial ports are configured as RS-232.
- opens the serial port using function `open_serial_port()`. Examine this function:
    - opens the serial device by calling `open()`.
    - reads current serial port attributes using `tcgetaddr()`.
    - configures serial port attributes. The routine uses `cfsetispeed()` to set the baud rate. It then uses `tcsetattr()` to set the remaining attributes.
- initializes the LEDs on the front panel.
- enters a for loop which transmits a test string one character at a time by calling `write()` and sleeping for 500 msec using `usleep()`.
- closes the serial drive connection using `close()`.

4.2.3 LED Sample

This program shows how to interact with the MVI69E-LDM hardware at the most basic level.

To run the LED sample:

1 Establish a command window using Telnet or similar terminal software program on the PC, through either the Ethernet or Serial P1 port.
2 Login as user: **root**, using password: **password**.

> **Note:** After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

To execute the sample:

1 Navigate to the default home directory `/psft/sample` and type the command `./Led_Sample&`. This will run the Led_Sample program in the background.
2 Looking at the sample source, you'll see that the program:
- registers Linux event handlers using the `signal` function.
- opens a connection to the hardware via the MVI69 library API `MVI69_Open`. Although the `MVI69_OpenNB` routine could be used (since this sample does not communicate across the backplane).
- reads the module information using `MVI69_GetModuleInfo` an displays this information to the terminal.
- reads the version information of the MVI69 driver using `MVI69_GetVersionInfo` and displays this information to the terminal.
- reads the state of the serial configuration jumpers using `ShowSerialJumpers` and prints this information to the terminal.
- reads the state of the Setup Jumper using the function `MVI69_GetSetupJumper` and prints this information to the console.
- initializes all LEDs to OFF.

3 The program then uses two nested loops to cycle through the LEDs and changes the state of the LED to every possible display state. This uses the `MVI69_SetLED` function.
4 Exit the program by killing it (CTRL-C or kill -9).

4.2.4 Backplane Sample

The Backplane Sample program shows block transfer communication with the CompactLogix controller in slot 0 of the CompactLogix rack. The CompactLogix controller must be loaded with the sample ladder logic and be configured to communicate with the MVI69E-LDM module. The ladder is `MVI69_LDMACD`.

To run the Backplane sample:

1 Establish a command window using Telnet or similar terminal software on the PC through either the Ethernet or Serial P1 port.
2 Login
user: `root`
password: `password`

Note: After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.

To execute the sample:

1 Navigate to the default home directory `/psft/sample` and type the command `./Backplane_Sample&` to run this program as a background task.
2 Reviewing the source code for the Backplane Sample, the program:

- registers Linux event handlers using the `signal` function.
- opens a connection to the hardware via the backplane library API using the `open_backplane` routine. The `open_backplane` will:
  - change the module information with the `MVI69_SetModuleInfo` routine.
  - call `MVI69_Open` to get access to the LDM hardware and backplane. (This call will wait in a loop until backplane access is obtained)
  - read the size of the configured IO using `MVI69_GetIOConfig`.
  - read and display the module identity using `MVI69_GetModuleInfo`.
- sets each of the front panel LEDs to a default using the `MVI69_SetLED` function.
- enters a main (infinite loop) within this loop. The program will:
  - first read the current run/program mode of the processor using `MVI69_GetScanMode`, and prints the state if it has changed since the last time it was read.
  - wait for an Input Scan from the CompactLogix processor using the `MVI69_WaitForInputScan` function.
    Note: `MVI69_WaitForOutputScan` could also be used.
  - `MVI69_GetScanCounter` function is used to read the number of the scan. The scan count modulo 5000 is used in data write (i.e., controller input data) a few lines below.
  - read output data (read data for the module) from the controller using the function `MVI69_ReadOutputImage`.
  - If the second element has changed since the last read, the new data is copied from the read (controller output) data to the write (controller input) data. If the data has not changed, the data in the writer buffer is decremented. The scan count (read above) is written to the 0th element.
  - write the data back for the controller to read using the `MVI69_WriteInputImage` function.

4.3 Application Tutorials

The following sections describe how to run and understand the sample applications provided with the module. These applications handle the data exchange between the backplane, MVI69E-LDM, and end device(s).

4.3.1 Ethernet Application

You cannot run this sample if Backplane_Sample is running. Backplane_Sample runs by default during startup. To run the enet_application sample, you must kill the Backplane_Sample script. See the section entitled "*Important Module Startup Information - Please Read*" for information on how to kill or change the Backplane_Sample script.

The Ethernet Communications program illustrates how to interact with the MVI69E-LDM using its Ethernet port as both a server and a client communicating through the backplane to send and receive data. The sample also uses multi-threading in order to run as both a server and client asynchronously.

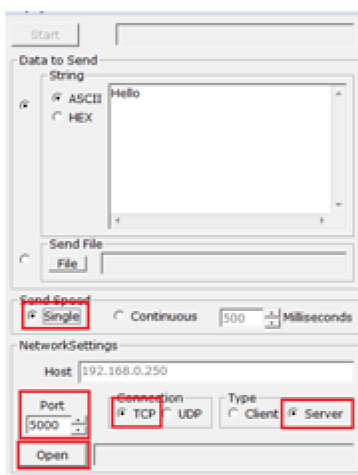
To test the MVI69E-LDM as a client:

1 Set up TCP Stress Tester as a server with the following parameters:

- **PORT**: 5000
- **CONNECTION**: TCP
- **SEND SPEED**: Single
- **TYPE**: Server

2 Subnet Example: `10.1.3.x` (or default 192.168.0.250)

3 Click **OPEN** and allow the TCP Stress Tester to listen once the sample program launches (steps to launch the sample program below)..



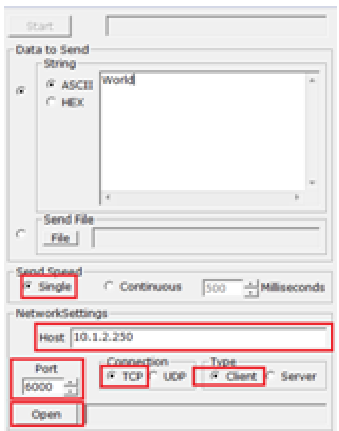
To test the MVI69E-LDM as a server:

1 Set up TCP Stress Tester as a client:

- **PORT**: 6000
- **CONNECTION**: TCP
- **SEND SPEED**: Single
- **TYPE**: Client

Subnet Example: `10.1.2.x` (or default 192.168.1.250).

2 Ensure that you use the IP address of one of the two Ethernet ports available on the MVI69E-LDM as the HOST address (information to access / set IP addresses in the module is discussed later).



3 Launch the sample ladder for the MVI69E-LDM in RSLogix 5000. Please observe that the module is not proceeding with I/O communications. This is normal. The sample program initiates backplane communication.

4 To communicate on the MVI69E-LDM, use Telnet or other terminal connection program to open a serial connection (baud 115200) to the COM port of choice on either of the two computers.

To change Ethernet port IP addresses to use the subnets chosen temporarily:

1 Type in the terminal console:
`ifconfig eth0 x.x.x.x` where 'x' is your IP address of choice for Ethernet Port 0.

2 Navigate to the sample directory
`cd /psft/sample.`

3 Type command `./enet_application` without the destination IP address when testing the MVI69E-LDM as a server. Type command `./enet_application x.x.x.x` where 'x' is the destination IP address of the server running TCP Stress Tester when testing the MVI69E-LDM as a client.

To initiate external client communication:

Click **OPEN** once the Ethernet Communications sample is running in RSLogix 5000 (you may have to click twice depending on your computer).

Once the program is running and a TCP Tester server and client information is established, data is received through the backplane and to/from the TCP Stress Testing applications and RSLogix 5000. The program modifies the tags within RSLogix 5000 using the sample ladder provided with any string input:

- Input Tags: 0-9 can be modified by the MVI69E-LDM client for the MVI69E-LDM.
- Output Tags: 0-9 can be modified by the TCP Tester server for the MVI69E-LDM.
- Input Tags: 11-20 can be modified by the MVI69E-LDM server of the MVI69E-LDM.
- Output Tags: 10-19 can be modified by the TCP Tester client of the MVI69E-LDM

Please note that it is recommended to set the 'Style' in RSLogix 5000 to 'ASCII' instead of INT or Hex due to the way that RSLogix 5000 interprets bytes and byte order.

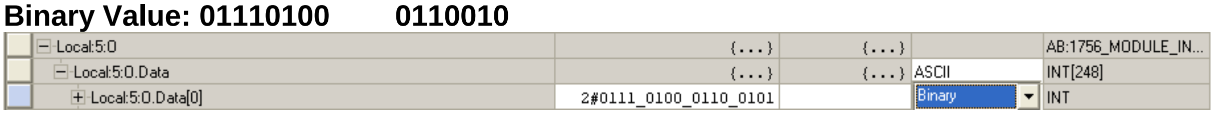
RSLogix 5000 creates a high byte and low byte for each tag in its database. For example, if the word 'Hello!' was typed from the TCP Stress Tester, RSlogix5000 separates the values to:

- 'eH'
- 'll'
- '!o'

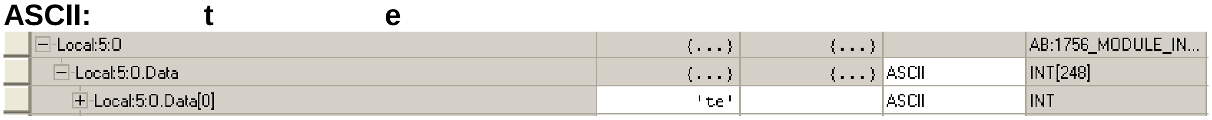
Since the values are read in byte order (from right most to left most), there is a high byte and low byte used and RSLogix 5000 combines those byte values in you choose to view it as in INT or Hex value.

For example, the letters 'te' in a single tag are separated and combined as follows:

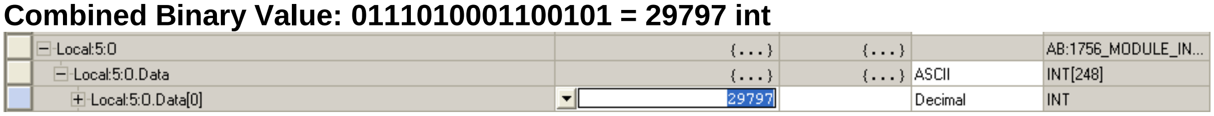
Binary Value: 01110100 0110010



ASCII: t e

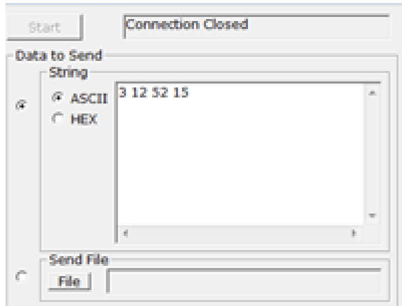


Combined Binary Value: 0111010001100101 = 29797 int



ASCII (INT Value): 101 116

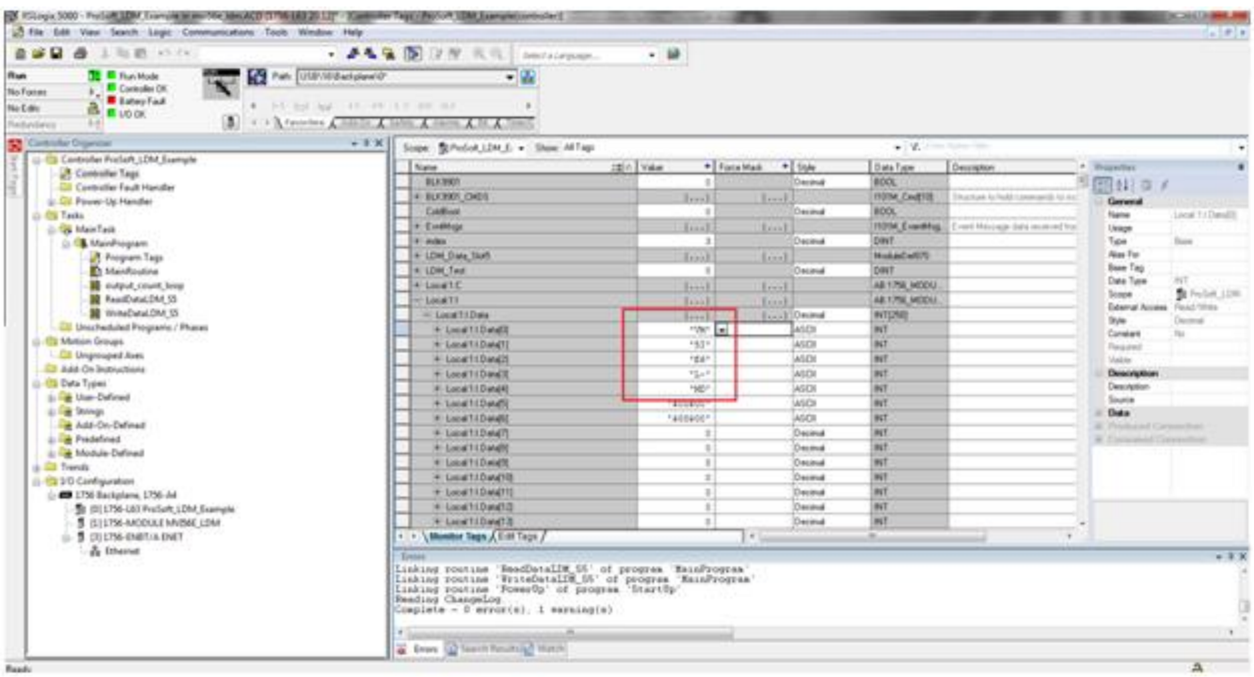
The sample application can have its sample ladder input tags modified via TCP Stress Tester either through the external server or the client by creating any string value up to 10 tag entries long (20 characters total, including spaces):

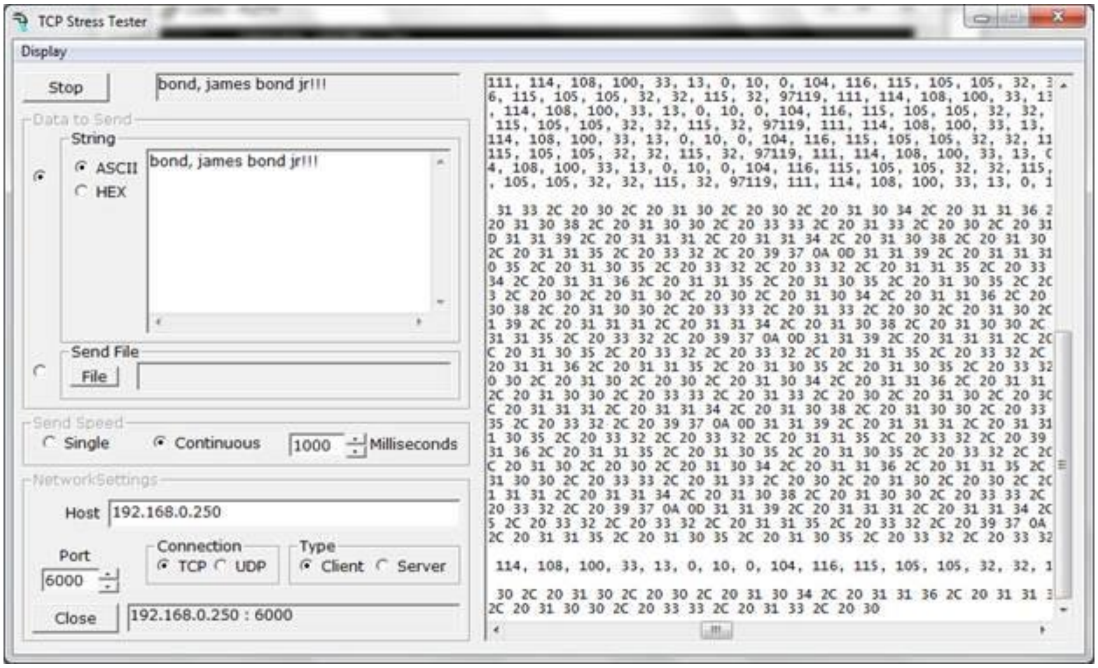


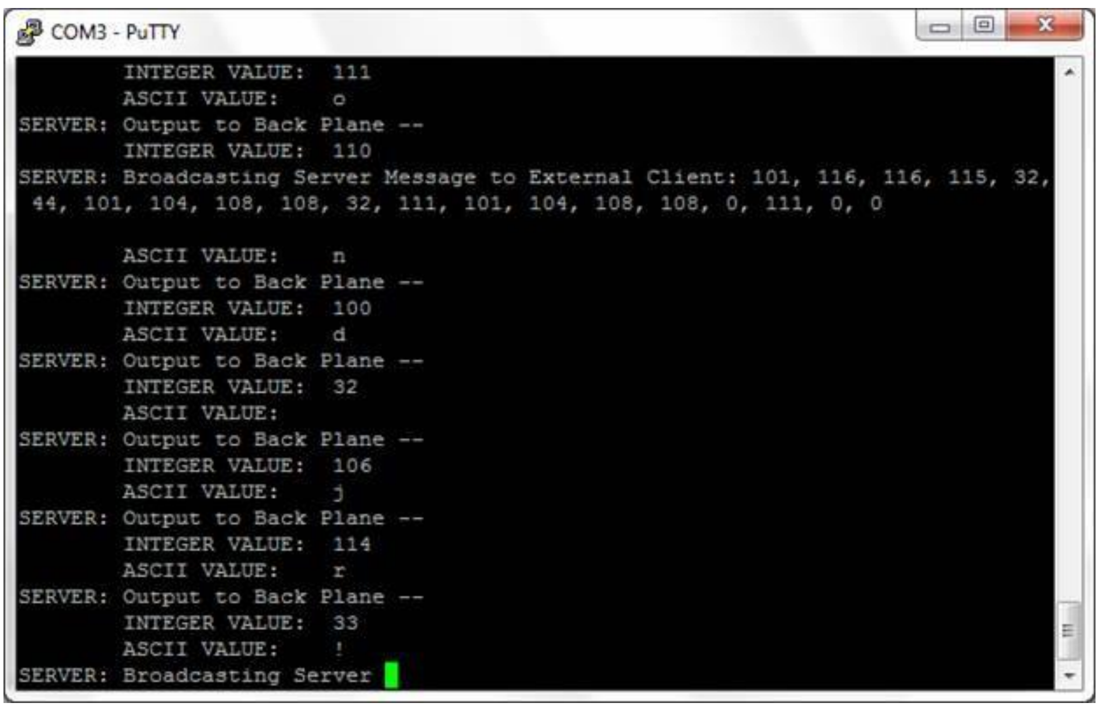
Click **START** to transmit the data from the computer into the module and backplane. It is then updated in RSLogix 5000 with the appropriate number associations.

As mentioned earlier, all character data is sent to RSLogix 5000 in sets of two per tag since each tag is 16 bits in length and each ASCII character resides in 8 bits (one byte). All ASCII information for each tag reads from right to left (low byte to high byte) as shown in the following example:

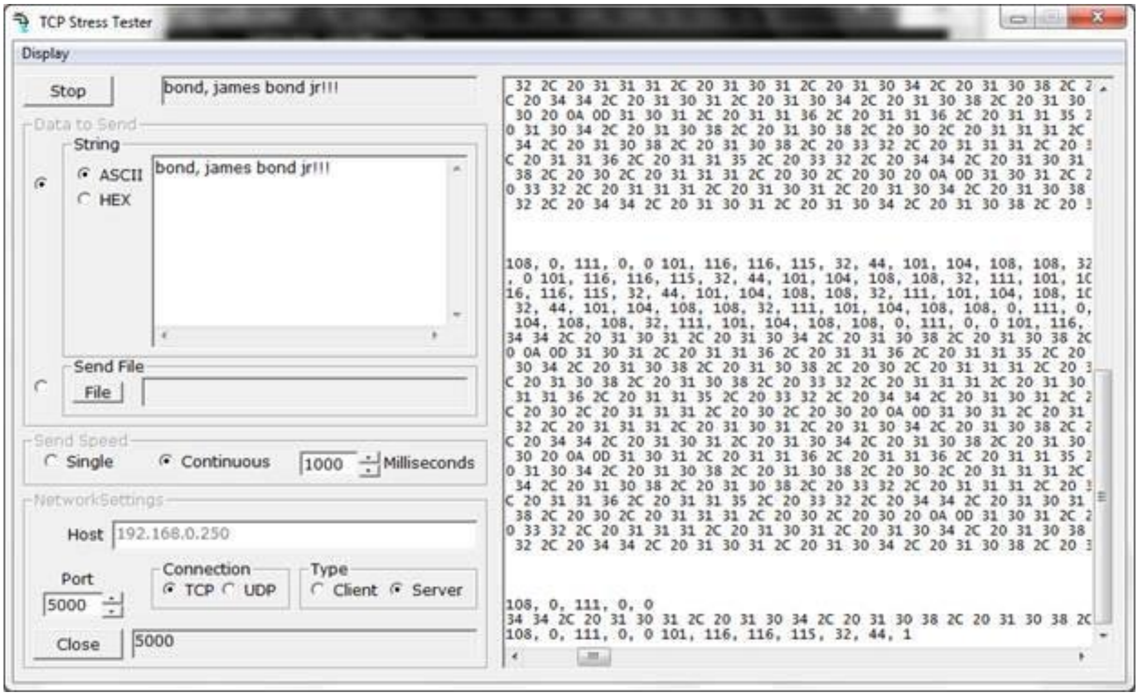
MVI69E-LDM Running as a Server

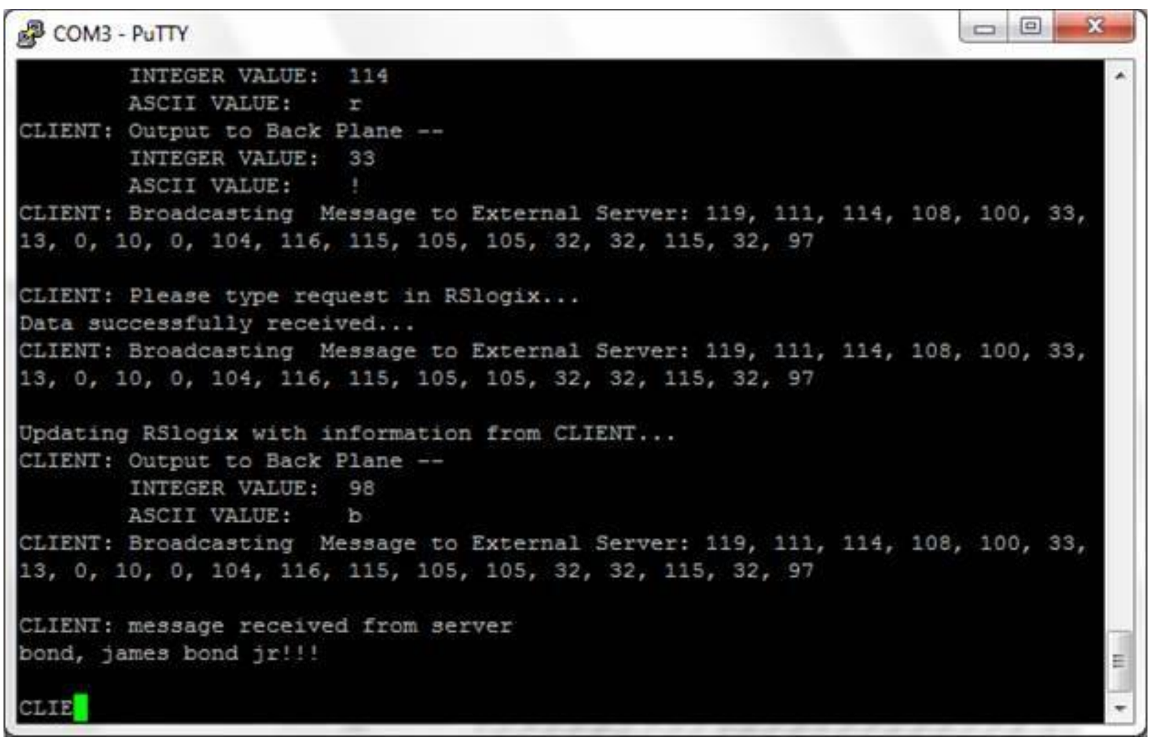



TCP Stress Tester
Display
Stop
bond, james bond jr!!!
Data to Send
String
ASCII
HEX
bond, james bond jr!!!
Send File
File
Send Speed
Single
Continuous
1000
Milliseconds
NetworkSettings
Host
192.168.0.250
Port
6000
Connection
TCP
UDP
Type
Client
Server
Close
192.168.0.250 : 6000

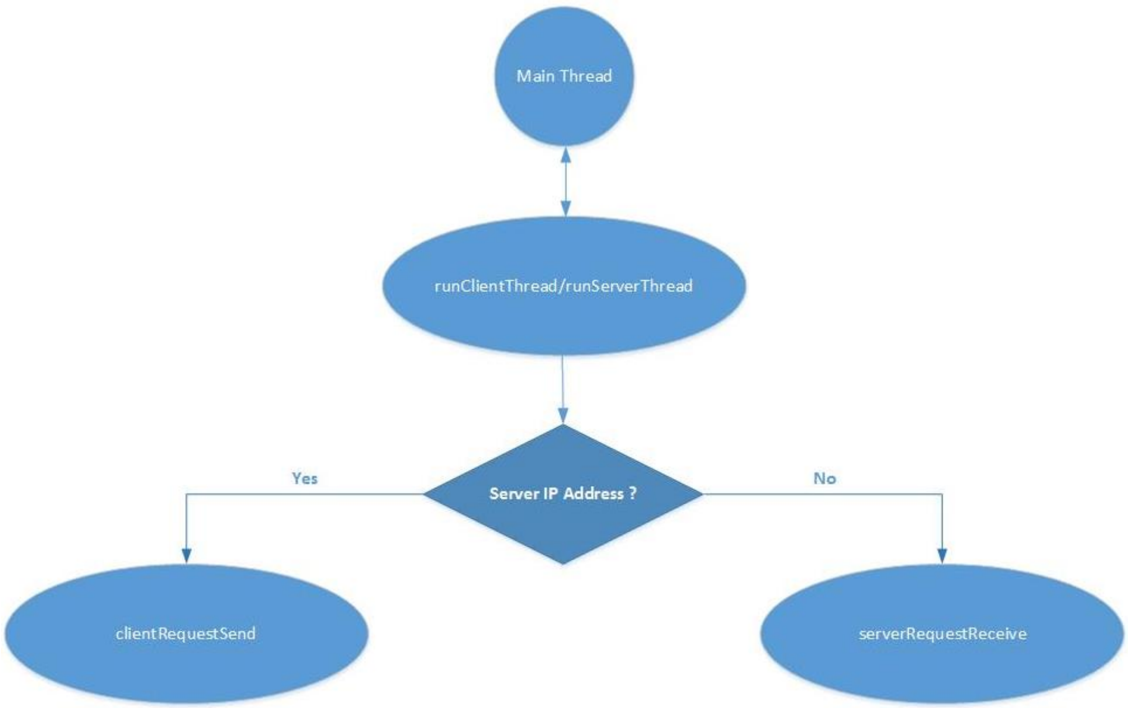

COM3 - PuTTY
INTEGER VALUE: 111
ASCII VALUE: o
SERVER: Output to Back Plane --
INTEGER VALUE: 110
SERVER: Broadcasting Server Message to External Client: 101, 116, 116, 115, 32,
44, 101, 104, 108, 108, 32, 111, 101, 104, 108, 108, 0, 111, 0, 0
ASCII VALUE: n
SERVER: Output to Back Plane --
INTEGER VALUE: 100
ASCII VALUE: d
SERVER: Output to Back Plane --
INTEGER VALUE: 32
ASCII VALUE:
SERVER: Output to Back Plane --
INTEGER VALUE: 106
ASCII VALUE: j
SERVER: Output to Back Plane --
INTEGER VALUE: 114
ASCII VALUE: r
SERVER: Output to Back Plane --
INTEGER VALUE: 33
ASCII VALUE: !
SERVER: Broadcasting Server

MVI69E-LDM Running as a Client





The following diagram shows the multi-threading hierarchy. All threads (excluding the main thread) can be removed/disabled and the sample will continue to function as directed, excluding the functionality of the removed thread and any child threads associated with it.



4.3.2 Serial Application

You cannot run this sample if Backplane_Sample is running. Backplane_Sample runs by default during startup. To run the serial_application sample, you must kill the Backplane_Sample script. See the section entitled "*Important Module Startup Information - Please Read*" for information on how to kill or change the Backplane_Sample script.

The Serial_Application shows an example of how you can use the LDM module to communicate to an end device to transmit/receive ASCII strings from the CompactLogix processor through the backplane to the LDM module on the bottom serial port (default application port). This same sample program:

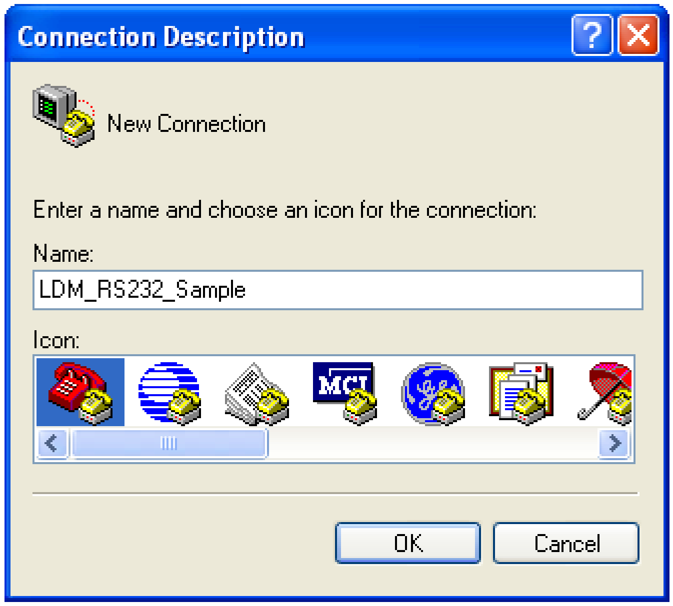
- Streams ASCII data into the module from the end device on the same serial port.
- Sends the data to the backplane to the controller tags of the CompactLogix.
- Sends out the number of bytes entered in Write_Byte_Cnt Controller tag continuously after the Serial_App_Sample_WriteTrigger tag has been triggered from the default application port.
- Streams in ASCII data from the end device into the Controller tag Local:1:I.Data.

To run the Serial Application sample:

Use HyperTerminal or a similar program to perform the following steps.

1 Open HyperTerminal.

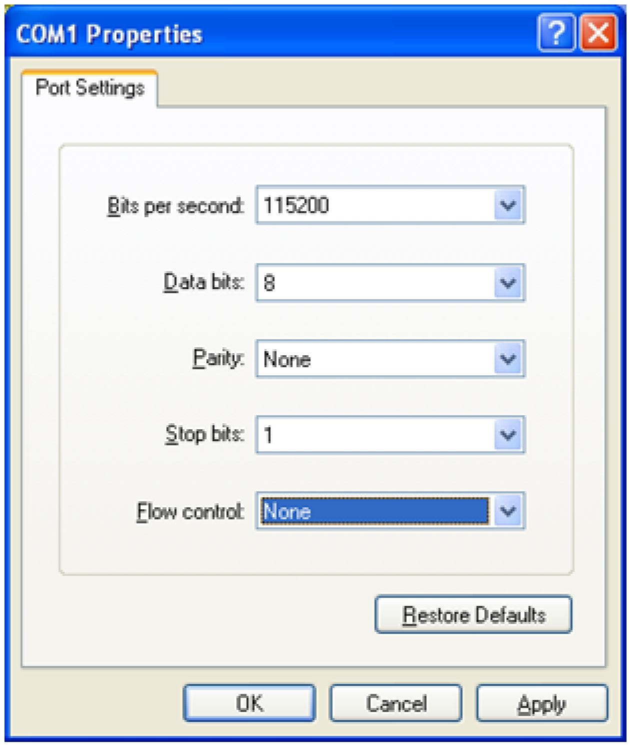
2 Enter a name and choose an icon for the connection.



3 Choose the appropriate COM port.

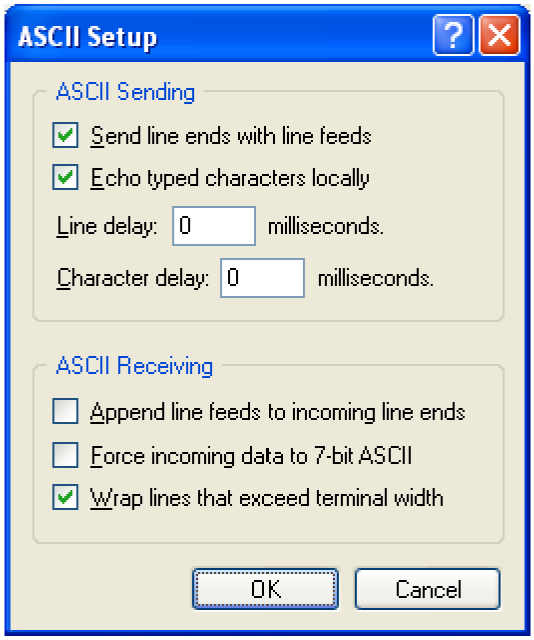
4 Use the following settings for the Serial_Application program.

- **BITS PER SECOND**: 115200
- **DATA BITS:** 8
- **PARITY:** None
- **STOP BITS:** 1
- **FLOW CONTROL**: None



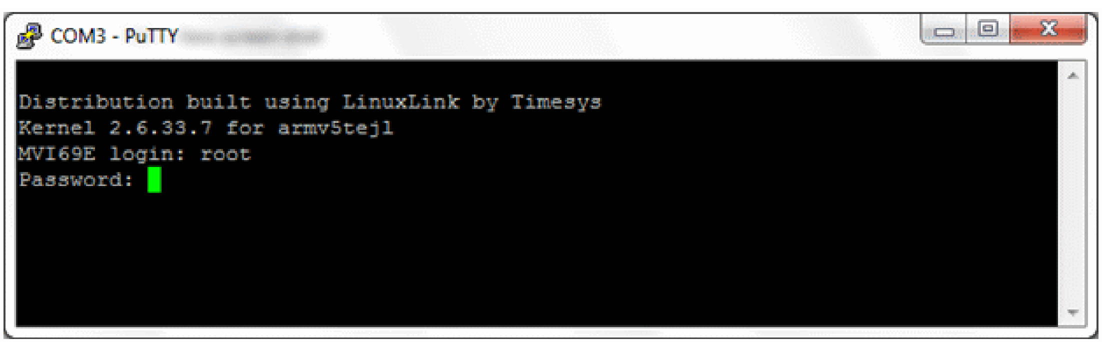
5 Under the **ASCII SETUP**, select **ECHO TYPED CHARACTER LOCALLY**. This allows you to see the stream data being sent to the LDM module on the HyperTerminal screen.

6 Click **OK**, but keep HyperTerminal open since you will use it again after you complete the following sections.

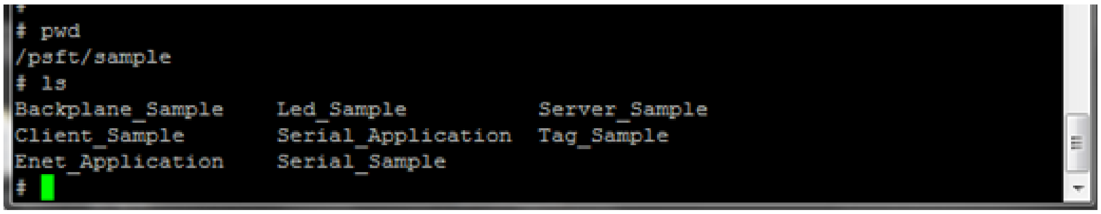


7 Use PuTTY or Telnet to log into the module.
MVI69E login: `root`
Password: `password`

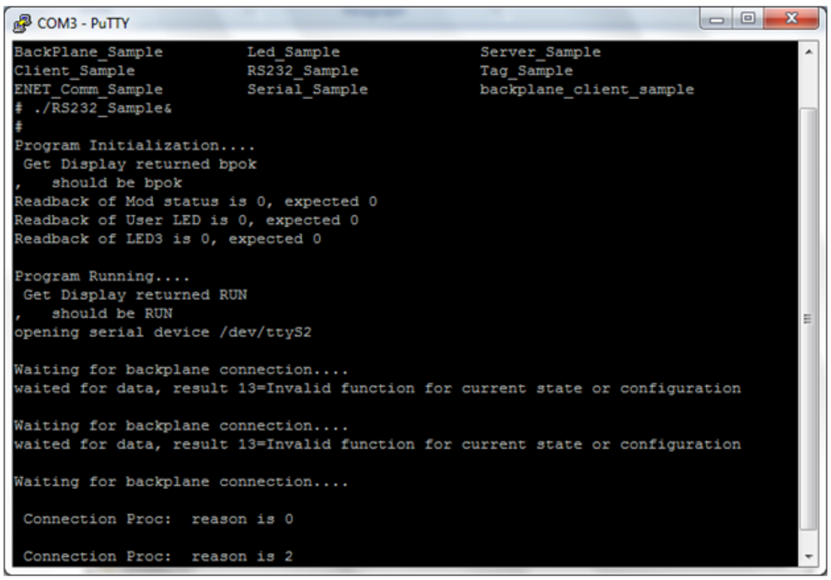
Note: After the first successful login, you will be prompted to change the password. Be sure to record the new password in a safe place for future reference.



8 Change to the Sample directory:
`cd /psft/sample`

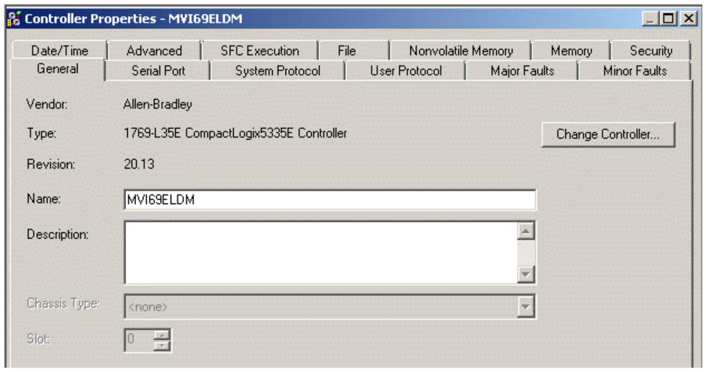


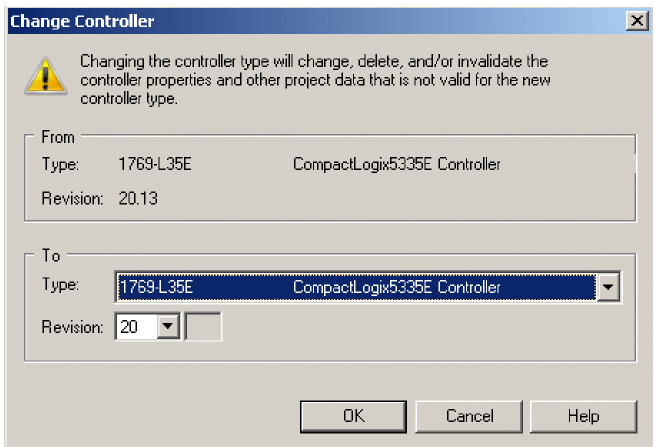
9 Type `./` and the name of the sample program that you want to run. In this example, type:
`./Serial_Application&`



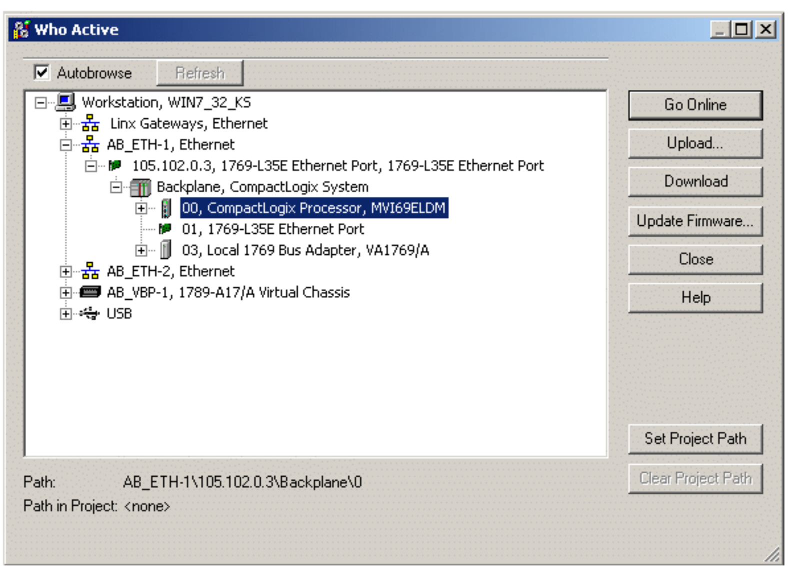
10 Keep PuTTY or Telnet open and set up the CompactLogix 5000 program as described in Setting Up the ControlLogix 5000.

11 Open the MVI69E-LDM.ACD program and change the appropriate chassis type to match your hardware and firmware.

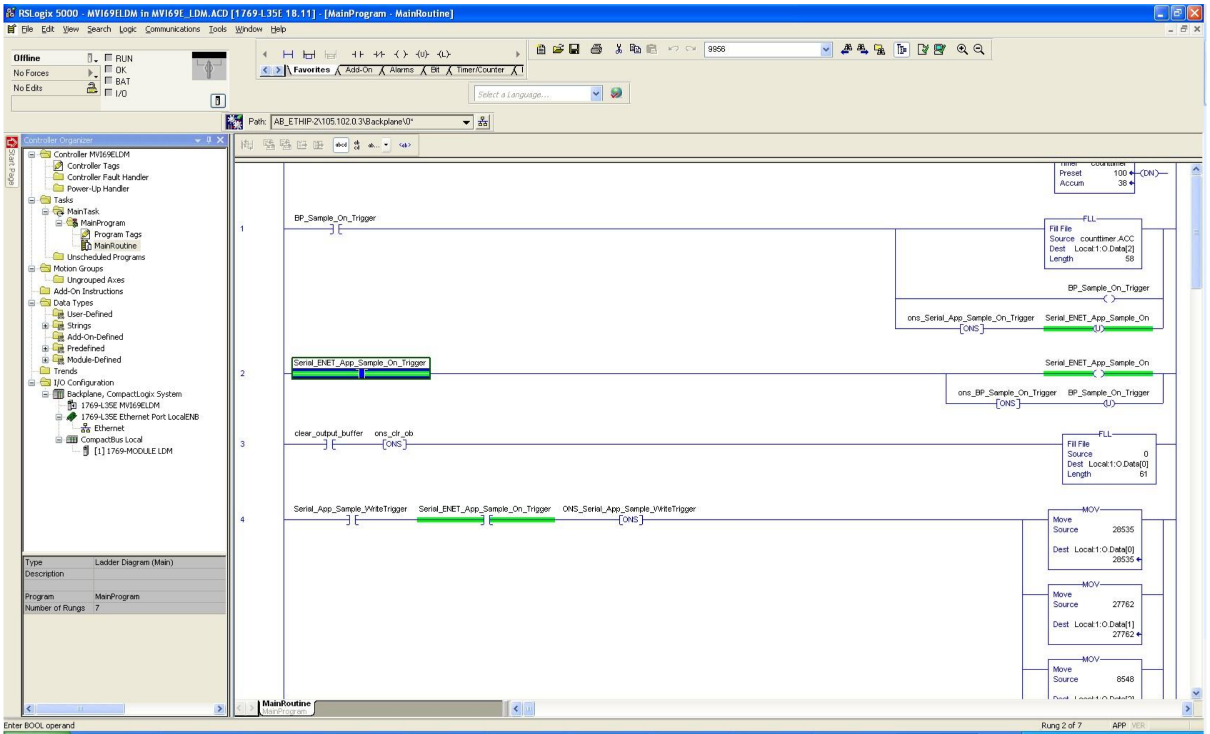




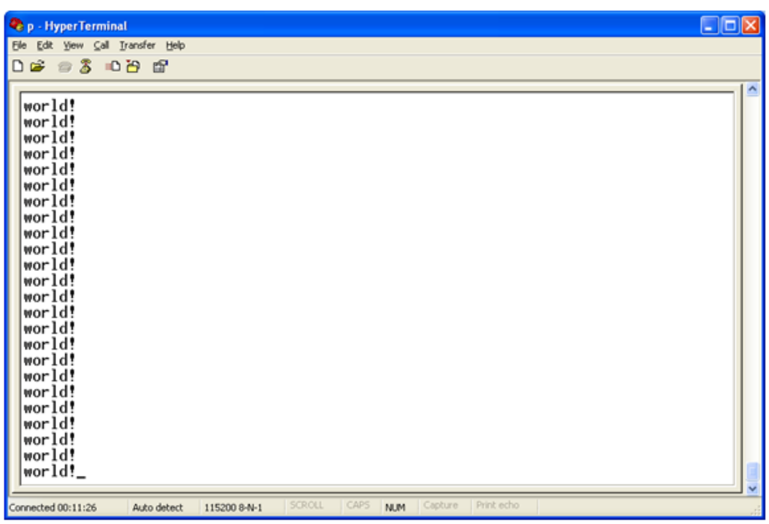
12 Download the MVI69E-LDM.ACD file in the CompactLogix processor by choosing **COMMUNICATIONS > WHO ACTIVE > DOWNLOAD.**



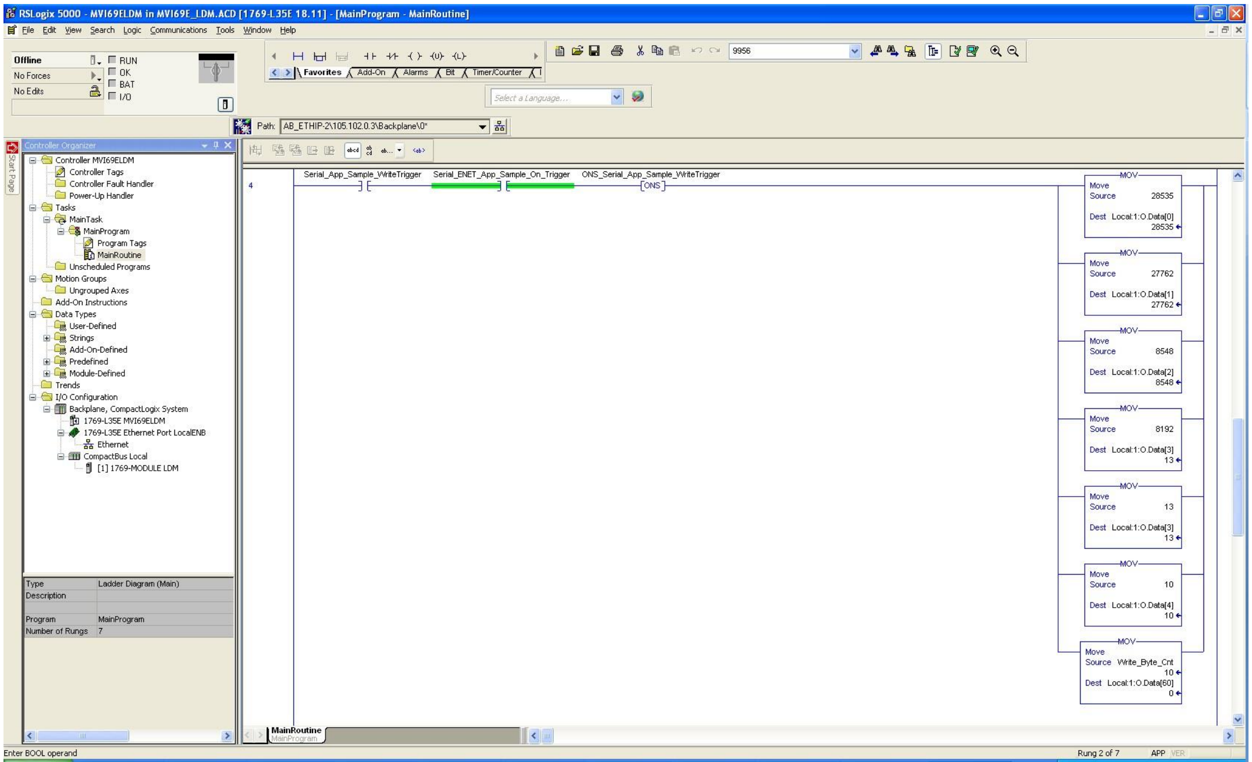
13 Trigger 'Serial_ENET_App_Sample_On_Trigger' by right-clicking the Controller tag and choosing **TOGGLE BIT**.



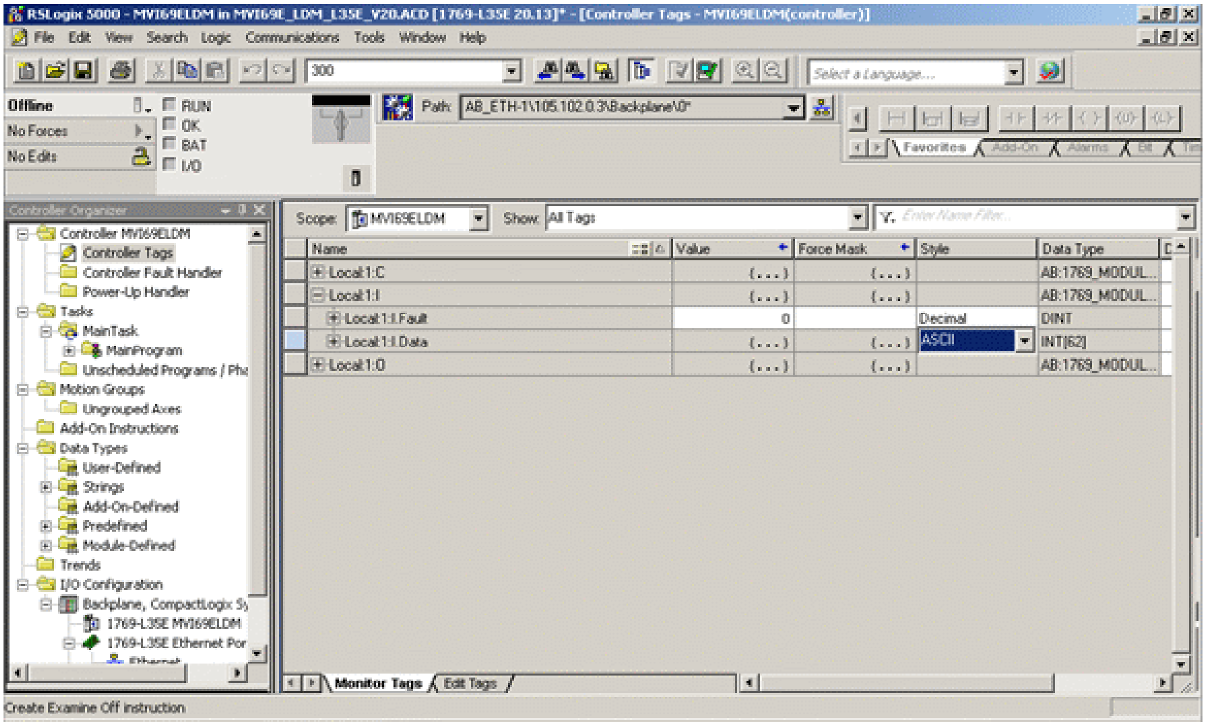
This causes the MVI69E-LDM module to send out the text `world!` to the console.



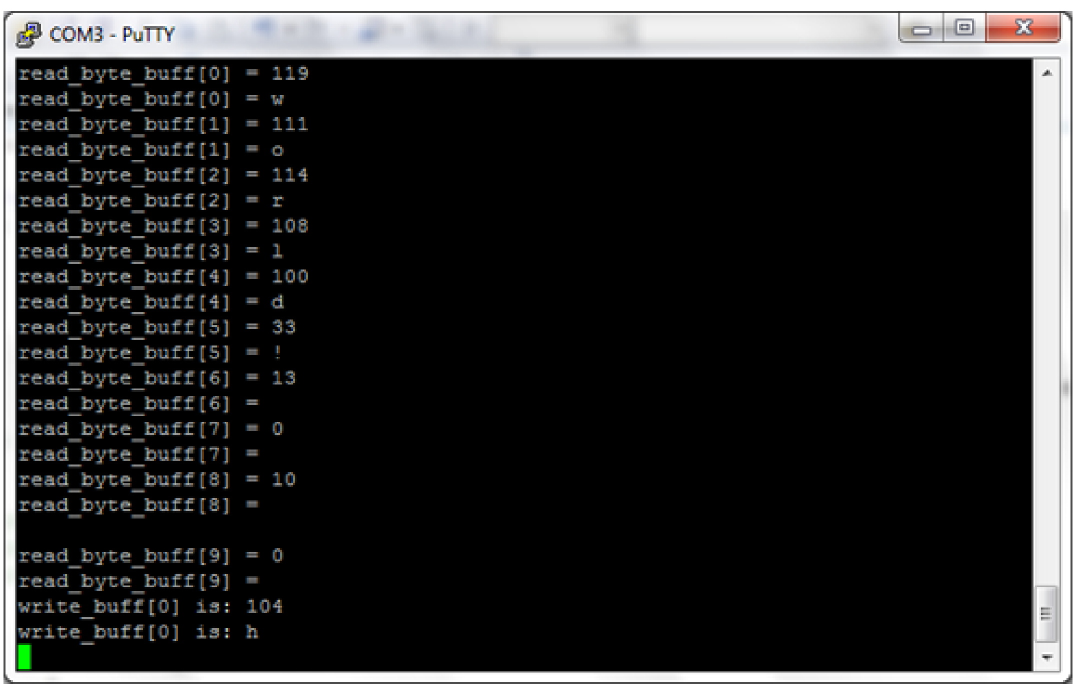
14 You can view how the stream of data is accepted by the LDM module by untoggling the Serial_App_Sample_WriteTrigger and typing a string of characters on the console.



15 You can see the letter '*h*' in the location '*Local:1:I.Data*'. Make sure that the **STYLE** column in the CompactLogix is set to ASCII.



16 You can also observe this on the console port as well.



5 API Functions

5.1 CIP API Initialization Functions

MVI69_Open

Syntax

```
int  MVI69_Open(MVI69HANDLE *handle);
```

Parameters

handle	Pointer to variable of type MVI69HANDLE

Description

`MVI69_Open` acquires access to the API and sets handle to a unique ID that the application uses in subsequent functions. This function must be called before any of the other API functions can be used (with the exception of `MVI69_SetModuleInfo`).

The function provides full access to the backplane and all of the API functions. Only one program is allowed to call this function.

IMPORTANT: Once the API is opened, `MVI69_Close` should always be called before exiting the application.

Return Value

MVI69_SUCCESS	API was opened successfully
MVI69_ERR_REOPEN	API is already open
MVI69_ERR_NODEVICE	Backplane driver could not be accessed

Note: `MVI69_ERR_NODEVICE` will be returned if the backplane device driver is not loaded.

Example

```
MVI69HANDLE Handle;
       if (MVI69_Open(&Handle)!= MVI69_SUCCESS)
{
       printf ("Open failed!\n");
}
else
{
       printf ("Open succeeded\n");
}
```

See Also

MVI69_Close
MVI69_OpenNB

MVI69_OpenNB

Syntax

```
int  MVI69_OpenNB(MVI69HANDLE *handle);
```

Parameters

Handle	pointer to variable of type MVI69HANDLE

Description

`MVI69_OpenNB` acquires access to the API and sets `Handle` to a unique ID that the application uses in subsequent functions. This function must be called before any of the other API functions can be used.

The purpose of this function is to provide access to certain API functions even if the API is already in use by another program. This function does not provide access to the backplane; however, it does provide access to the following functions.

```
MVI69_GetModuleInfo
MVI69_GetSerialConfig
MVI69_SetSerialConfig
MVI69_GetSetupJumper
MVI69_SetLED
MVI69_GetVersionInfo
```

IMPORTANT: Once the API has been opened, `MVI69_Close` should always be called before exiting the application.

Return Value

MVI69_SUCCESS	API was opened successfully
MVI69_ERR_REOPEN	API is already open
MVI69_ERR_NODEVICE	Backplane driver could not be accessed.

Note: `MVI69_ERR_NODEVICE` is returned if the backplane device driver is not loaded.

Example:

```
MVI69Handle   Handle;
if ( MVI69_OpenNB(&handle)!=MVI69_SUCCESS) {
    printf ("Open failed!\n");
} else {
    printf ("Open succeeded\n");
}
```

See Also

MVI69_Open

MVI69_Close

MVI69_Close

Syntax

```
int  MVI69_Close(MVI69HANDLE handle);
```

Parameters

handle	handle returned by previous call to MVI69_Open or MVI69_OpenNB

Description

This function is used by an application to release control of the API.

handle must be a valid handle returned from `MVI69_Open` or `MVI69_OpenNB`.

IMPORTANT: Once the API has been opened, this function should always be called before exiting the application.

Return Value

`MVI69_SUCCESS`	API was closed successfully
`MVI69_ERR_NOACCESS`	*handle* does not have access

Example

```
MVI69HANDLE handle;
MVI69_Close (handle);
```

See Also

MVI69_OpenNB

MVI69_Open

After the CIP API has been opened, this function should always be called before exiting the application.

MVI69_GetIOConfig

Syntax

```
int  MVI69_GetIOConfig(MVI69HANDLE    apihandle,
                           MVI69_IOCONFIG *ioconfig);
```

Parameters

handle	handle returned by previous call to MVI69_Open
ioconfig	Pointer to MVI69IOCONFIG structure to receive configuration information.

Description

This function is used to obtain the IO configuration of the MVI69E module. *handle* must be a valid handle returned from MVI69_Open.

The MVI69IOCONFIG structure is defined as shown:

```
typedef struct tagMVI69IOCONFIG
{
WORD MappedInputWords;//Input words available for direct access
WORD MappedOutputWords;//Output words available for direct access.
WORD MsgRcvBufSize;//Max size in words for received messages.
WORD MsgSndBufSize;//Max size in words for sent messages.
} MVI69IOCONFIG;
```

The maximum sizes in words of the module's input images are returned in the MVI69IOCONFIG structure pointed to by ioconfig. The MappedInputWords and MappedOutputWords members are set equal to the number of words of the respective image that is available for direct access via the MVI69_WriteInputImage or MVIbpReadOutputImage functions. The MsgRcvBufSize and MSgSndBufSize members indicate the maximum size in words for received or sent messages respectively..

Return Value

MVI69_SUCCESS	no errors were encountered
MVI69_ERR_NOACCESS	handle does not have access

Example

```
MVI69HANDLE  handle;
MVI69IOCONFIG    ioconfig;

MVI69_GetIOConfig (handle, &ioconfig);
printf ("%d words of input image available\n", ioconfig.DirectInputSize);
printf ("%d words of output image available\n", ioconfig.DirectOutputSize);
```

See Also

MVI69_SetIOConfig

MVI69_SetIOConfig

Syntax

```
int  MVI69_SetIOConfig(MVI69HANDLE    apihandle,
                          MVI69_IOCONFIG *ioconfig);
```

Parameters

`handle`	handle returned by previous call to MVI69_Open
`ioconfig`	Pointer to MVI69IOCONFIG structure to receive configuration information.

Description

This function may be used to set the size of the module's IO images available for direct IO access. *handle* must be a valid handle returned from MVI69_Open.

The actual number of input and output words that are transferred between the controller and the MVI69E module is determined by the configuration of the generic profile. The only purpose of this routine is to set maximum sizes allowed by the MVI69_ReadOutputImage and MVI69_WriteInputImage functions.

The message buffer sizes are fixed. Therefore, the MsgRcvBufSize and MsgSndBufSize members are ignored by this function.

Return Value

`MVI69_SUCCESS`	no errors were encountered
`MVI69_ERR_NOACCESS`	handle does not have access
`MVI69_ERR_BADCONFIG`	Configuration is not valid

Example

```
MVI69HANDLE  handle;
MVI69IOCONFIG    ioconfig;

ioconfig.DirectInputSize = 20;  //20words used for input
ioconfig.DirectOutputSize = 10; //10 words used for output
if (MVI69_SUCCESS !=MVI69_SetIOConfig (handle, &ioconfig))
  printf ("Error: IO COnfiguration failed\n");
```

See Also

MVI69_GetIOConfig

5.2 Direct I/O Access

MVI69_ReadOutputImage

Syntax

```
int  MVI69_ReadOutputImage (MVI69HANDLE handle,
                             WORD  offset,
                             WORD  length,
                             WORD  *buffer);
```

Parameters

`handle`	handle returned by previous call to`MVI69_Open`
`offset`	word offset into output image at which to begin reading
`length`	number of words to read
`buffer`	pointer to buffer to receive data from output image

Description

MVI69_ReadOutputImage reads from the module's output image.

`handle` must be a valid handle returned from `MVI69_Open`.

`buffer` must point to a buffer of at least length words in size.

`offset` specifies the word in the output image to begin reading, and length specifies the number of words to read. The error MVI69_ERR_BADPARAM will be returned if an attempts is made to access the output image beyond the range configured for direct IO. See the `MVI69_GetIOConfig` and `MVI69_SetIOConfig` functions for more information.

The output image is written by the control processor and read by the module.

Return Value

`MVI69_SUCCESS`	data was read from the output image successfully
`MVI69_ERR_NOACCESS`	*handle* does not have access
`MVI69_ERR_BADPARAM`	Parameter contains invalid value

Example

```
MVI69HANDLE handle;
WORD        buffer[8];
int         rc;

/* Read 8 words of data from the output image, starting with word 2*/
rc = MVI69_ReadOutputImage (Handle, 2, 8, buffer);
if (rc != MVI69_SUCCESS)
   printf("ERROR: MVI69_ReadOutputImage failed");
```

See Also

MVI69_GetIOConfig

MVI69_SetIOConfig

MVI69_WriteInputImage

MVI69_WriteInputImage

Syntax

```
int  MVI69_WriteInputImage (MVI69HANDLE handle,
                            WORD  offset,
                            WORD  length,
                            WORD  *buffer);
```

Parameters

`handle`	handle returned by previous call to `MVI69_Open`
`offset`	word offset into output image at which to begin writing
`length`	number of words to write
`buffer`	pointer to buffer of data to be written to input image

Description

MVI69_WriteInputImage writes to the module's input image.

`handle` must be a valid handle returned from `MVI69_Open`.

`buffer` must point to a buffer of at least length words in size.

`offset` specifies the word in the output image to begin reading, and length specifies the number of words to write. The error MVI69_ERR_BADPARAM will be returned if an attempt is made to access the input image beyond the range configured for direct IO. If this error is returned, no data will be written to the input image. See the `MVI69_GetIOConfig` and `MVI69_SetIOConfig` functions for more information.

The input image is written by the module and read by the control processor.

Return Value

`MVI69_SUCCESS`	data was written to the input image successfully
`MVI69_ERR_NOACCESS`	*handle* does not have access
`MVI69_ERR_BADPARAM`	Parameter contains invalid value

Example

```
MVI69HANDLE handle;
WORD        buffer[2];
int         rc;

/* Write 2 words of data to the input image, starting with word 0*/
rc = MVI69_WriteInputImage (Handle, buffer, 0, 2);
if (rc != MVI69_SUCCESS)
   printf("ERROR: MVI69_WriteInputImage failed");
```

See Also

MVI69_GetIOConfig

MVI69_SetIOConfig

MVI69_ReadOutputImage

5.3 Messaging

MVI69_GetMsgRequestFromBp

Syntax

```
int MVI69_GetMsgRequestFromBp(MVI69HANDLE handle,
                              WORD *buffer,
                              WORD *length,
                              WORD reserved,
                              WORD timeout);
```

Parameters

`handle`	handle returned by previous call to `MVI69_Open`
`buffer`	pointer to buffer to receive message data from processor
`length`	pointer to variable containing the maximum message length in words. When this function is called, this should be set to the size of the indicated buffer. Upon successful return, this variable will contain the actual received message length.
`timeout`	maximum number of milliseconds to wait for message

Description

This function retrieves a message sent from the control processor.

handle must be a valid handle returned from MVI69_Open.

Upon calling this function, length should contain the maximum message size in words to be received. buffer must point to a buffer of at least length words in size. Upon successful return, length will contain the actual length of the message received.

If length exceeds the maximum message size specified by the value MsgRcvBufSize (see the MVI69_GetIOConfig function), MVI69_ERR_BADPARAM will be returned.

timeout specifies the number of milliseconds that the function will wait for a message. To poll for a message without waiting, set timeout to zero. If no message has been received, MVI69_ERR_TIMEOUT will be returned.

If the message received from the control processor is larger than length, the message will be truncated to length words and MVI69_ERR_MSGTOOBIG will be returned.

If the call returns MVI69_SUCCESS, buffer will contain the message in the following format:

Name	Data Type	Description
MessageId	WORD	Message ID. Used to match responses to requests.
SizeofMessage	WORD	Size of the Message data in bytes.
Message[...]	BYTEs	CIP Message packet, starting with Service Code. Total number of bytes is provided in the SizeofMessage field.

The API does not act upon any data of the Message, nor does it monitor response timeouts. The user application is responsible for parsing the message and generating a response.

The API can queue up to 8 requests and they remain queued after the message is given to the user application. The user application must generate a response in order to free the message from the queue.

Return Value

`MVI69_SUCCESS`	a message has been received.
`MVI69_ERR_NOACCESS`	`handle` does not have access
`MVI69_ERR_TIMEOUT`	the timeout occurred before a message was received
`MVI69_ERR_BADPARAM`	a parameter is invalid
`MVI69_ERR_BADCONFIG`	receive messaging is not enabled

Example

```
MVI69HANDLE handle;
int         rc;
WORD        buffer[250]
WORD        length;

length = 250; //maximum message size that can be received
//wait up to 5 seconds for a message
rc = MVI69_GetMsgRequestFromBp (Handle, buffer, &length, 5000);
if (rc == MVI69_SUCCESS)
    printf ("Message received. Length is %d words\n", length);
```

See Also

MVI69_GetIOConfig

MVI69_SendMsgResponseToBp

MVI69_SendMsgResponseToBp

Syntax

```
int MVI69_SendMsgResponseToBp(MVI69HANDLE handle,
                              WORD *buffer,
                              WORD *length,
                              WORD reserved,
                              WORD timeout);
```

Parameters

`handle`	handle returned by previous call to `MVI69_Open`
`buffer`	pointer to buffer to send to processor
`length`	the length in words of the message to send
`timeout`	maximum number of milliseconds to wait to send message

Description

This function sends a response to the control processor.

handle must be a valid handle returned from MVI69_Open.

Upon calling this function, length should contain the response size in words. buffer must point to a buffer of at least length words in size.

If length exceeds the maximum response size specified by the value MsgSndBufSize (see the MVI69_GetIOConfig function), MVI69_ERR_BADPARAM will be returned.

When this function is called, the buffers data must contain the message in the following format:

Name	Data Type	Description
MessageId	WORD	Must echo MessageID of request
SizeofMessage	WORD	Size of the Message data in bytes.
Message[...]	BYTE’s	CIP Response packet, starting with Service Response. Total number of bytes is provided in the SizeofMessage field.

The API uses the MessageId field to match responses to requests from the backplane. Once the API matches a response to its request, the response will be forwarded to the backplane and the original request can be released.

The API does not act upon any data of the Message.

Since the API maintains an internal queue of 8 messages, the user application must generate responses to allow reception of more than 8 messages. If 8 requests are queued and the API receives another request, it will be dropped.

If the SizeofMessage field is set to 0, the original request is released and no response is sent to the backplane. This allows the user application to flush messages.

Return Value

MVI69_SUCCESS	a message has been received.
MVI69_ERR_NOACCESS	handle does not have access
MVI69_ERR_BADPARAM	a parameter is invalid
MVI69_ERR_BADCONFIG	send messaging is not enabled

Example

```
MVI69HANDLE handle;
int         rc;
WORD        buffer[250];


//wait 5 seconds for the message to be sent
rc = MVI69_SendMsgResponseToBp (Handle, buffer, 250);
if (rc == MVI69_SUCCESS)
    printf ("Message sent\n");
```

See Also

MVI69_GetIOConfig
MVI69_GetMsgRequestFromBp

5.4 Synchronization

MVI69_WaitForInputScan

Syntax

```
int MVI69_WaitForInputScan (MVI69HANDLE handle,
                              WORD timeout);
```

Parameters

handle	handle returned by previous call to MVI69_Open
timeout	maximum number of milliseconds to wait for scan

Description

MVI69_WaitForInputScan allows an application to synchronize with the scan of the module's input image. This function will return immediately after the input image has been read. This function may also be used by a module application to determine if the backplane is active.

handle must be a valid handle returned from MVI69_Open. timeout specifies the number of milliseconds that the function will wait for the input scan to occur.

Note: There is no distinction in teh MVI69E module between input and output scans. Therefore, the MVI69_WaitForInputScan and MVI69_WaitForOutputScan functions will perform exactly the same function and are interchangeable.

Return Value

MVI69_SUCCESS	the input scan has occurred.
MVI69_ERR_NOACCESS	handle does not have access
MVI69_ERR_TIMEOUT	the timeout expired before an input scan occurred

Example

```
MVI69HANDLE handle;

/*wait here until input scan, 50ms timeout */
rc = MVI69_WaitForInputScan (Handle, 50);
if (rc == MVI69_ERR_TIMEOUT)
    printf ("Message scan did not occur within 50 milliseconds\n");
else
    printf ("Input scan has occurred\n");
```

See Also

MVI69_WaitForOutputScan

MVI69_WaitForOutputScan

Syntax

```
int MVI69_WaitForOutputScan (MVI69HANDLE handle,
                              WORD timeout);
```

Parameters

`handle`	handle returned by previous call to `MVI69_Open`
`timeout`	maximum number of milliseconds to wait for scan

Description

MVI69_WaitForOutputScan allows an application to synchronize with the scan of the module's output image. This function will return immediately after the modules output image has been written.

handle must be a valid handle returned from MVI69_Open. timeout specifies the number of milliseconds that the function will wait for the output scan to occur.

Note: There is no distinction in the MVI69E module between input and output scans. Therefore, the MVI69_WaitForInputScan and MVI69_WaitForOutputScan functions will perform exactly the same function and are interchangeable.

Return Value

`MVI69_SUCCESS`	the output scan has occurred.
`MVI69_ERR_NOACCESS`	`handle` does not have access
`MVI69_ERR_TIMEOUT`	the timeout expired before an output scan occurred

Example

```
MVI69HANDLE handle;
int         rc;

/*wait here until output scan, 50ms timeout */
rc = MVI69_WaitForOutputScan (Handle, 50);
if (rc == MVI69_ERR_TIMEOUT)
    printf ("Output scan did not occur within 50 milliseconds\n");
else
    printf ("Output scan has occurred\n");
```

See Also

MVI69_WaitForInputScan

5.5 Serial Ports

The API functions in this section can be used to access tag data withing CompactLogix controllers. The prototypes for most of these functions and their associated data structure definitions can be found in the header file OCXTagDb.h.

The tag access functions that include "Db" in the name are for use with a valid tag database (see *OCXcip_BuildTagDb*).

MVI69_GetSerialConfig

Syntax

```
int MVI69_GetSerialConfig (MVI69HANDLE handle,
                            MVI69SPCONFIG *spconfig);
```

Parameters

`handle`	handle returned by previous call to `MVI69_Open`
`spconfig`	pointer to structure of type MVI69SPCONFIG

Description

MVI69_GetSerialConfig retrieves the state of the serial port configuration jumper for the port specified. The information is returned in the structure spconfig.

handle must be a valid handle returned from MVI69_Open.

The MVI69SPCONFIG structure is defined as follows:

```
typedef struct tagMVI69SPCONFIG
{
       int port_num;     /* Port number (1 or 2) */
       int port_cfg;     /* Jumper position */
}   MVI69SPCONFIG;
```

port_num must be set to the desired port before calling this function. Upon return, port_cfg will be set to one of the following values:

MVI69_SERIAL_CONFIG_NONE (No jumper installed)

MVI69_SERIAL_CONFIG_RS-232

MVI69_SERIAL_CONFIG_RS-422

MVI69_SERIAL_CONFIG_RS-485

Return Value

`MVI69_SUCCESS`	the configuration information was read successfully
`MVI69_ERR_NOACCESS`	`handle` does not have access

Example

```
MVI69HANDLE     handle;
MVI69SPCONFIG   spconfig;

/*Get jumper setting for Port 2 and verify that it is RS-232*/
spconfig.port_num = 2
MVI69_GetSerialConfig (Handle, &spconfig);
if (spconfig.port_cfg != MVI69_SERIAL_CONFIG_RS232)
      printf ("Port 2 is not configured for RS-232");
```

See Also

MVI69_SetSerialConfig

MVI69_SetSerialConfig

Syntax

```
int MVI69_SetSerialConfig (MVI69HANDLE handle,
                            MVI69SPCONFIG *spconfig);
```

Parameters

`handle`	handle returned by previous call to `MVI69_Open`
`spconfig`	pointer to structure of type MVI69SPCONFIG

Description

MVI69_SetSerialConfig sets the serial port configuration. This function overrides the serial port configuration jumper setting. The port number and configuration are specified in the structure spconfig.

handle must be a valid handle returned from MVI69_Open.

The MVI69SPCONFIG structure is defined as follows:

```
typedef struct tagMVI69SPCONFIG
{
       int port_num;      /* Port number (1 or 2) */
       int port_cfg;      /* Jumper position */
}   MVI69SPCONFIG;
```

Return Value

`MVI69_SUCCESS`	the configuration information was read successfully
`MVI69_ERR_NOACCESS`	`handle` does not have access

Example

```
MVI69HANDLE     handle;
MVI69SPCONFIG   spconfig;

/* Set up port 2 for RS-232*/
spconfig.port_num = 2;
spconfig.port_cfg = MVI69_SERIAL_CONFIG_RS232;
MVI69_SetSerialConfig (Handle, &spconfig);
```

See Also

MVI69_GetSerialConfig

5.6 Miscellaneous Functions

MVI69_GetVersionInfo

Syntax

```
int MVI69_GetVersionInfo (MVI69HANDLE handle,
                            MVI69VERSIONINFO *verinfo);
```

Parameters

handle	handle returned by previous call to MVI69_Open
verinfo	pointer to structure of type MVI69VERSIONINFO

Description

MVI69_GetVersionInfo retrieves the current version of the API library and the backplane device driver. This information is returned in the structure verinfo.

handle must be a valid handle returned from MVI69_Open.

The MVI69VERSIONINFO structure is defined as follows:

```
typedef struct tagMVI69VERSIONINFO
{
     WORD  APISeries;    /* API series */
     WORD  APIRevision;  /* API revision */
     WORD  DDSeries;     /* Device driver series */
     WORD  DDRevision;   /* Device driver revision */
}  MVI69VERSIONINFO
```

Return Value

MVI69_SUCCESS	the version information was read successfully
MVI69_ERR_NOACCESS	handle does not have access

Example

```
MVI69HANDLE        handle;
MVIBPVERSIONINFO   verinfo;

/* print version of API library and driver */
MVI69_GetVersionInfo (handle, &verinfo);
printf("Library Series %d, Rev %d\n", verinfo.APISeries, verinfo.APIRevision);
printf("Driver Series &d, Rev %d\n, verinfo.DDSeries, verinfo.DDRevision);
```

MVI69_GetModuleInfo

Syntax

```
int MVI69_GetModuleInfo (MVI69HANDLE handle,
                            MVI69MODULEINFO *modinfo);
```

Parameters

`handle`	handle returned by previous call to `MVI69_Open`
`modinfo`	pointer to structure of type MVI69MODULEINFO

Description

MVI69_GetModuleInfo retrieves identity information for the module This information is returned in the structure modinfo.

handle must be a valid handle returned from MVI69_Open.

The MVI69MODULEINFO structure is defined as follows:

```
typedef struct tagMVIBPMODULEINFO
{
     WORD  VendorID;        /* Reserved */
     WORD  DeviceType;      /* Reserved */
     WORD  ProductCode;     /* Device model code */
     BYTE  MajorRevision;   /* Device major revision */
     BYTE  MinorRevision;   /* Device minor revision */
     DWORD SerialNo;        /* Serial number */
     BYTE  Name[32];        /* Device name (string) */
}  MVI69MODULEINFO
```

Return Value

`MVI69_SUCCESS`	the module information was read successfully
`MVI69_ERR_NOACCESS`	`handle` does not have access

Example

```
MVI69HANDLE        handle;
MVIBPMODULEINFO   modinfo;

/* print module name */
MVI69_GetModuleInfo (handle, &modinfo);
printf("Name is %s\n", modinfo.Name);
```

See Also

MVI69_SetModuleInfo

MVI69_SetModuleInfo

Syntax

```
int MVI69_SetModuleInfo (MVI69HANDLE handle,
                            MVI69MODULEINFO *modinfo);
```

Parameters

`handle`	not used - set to 0
`modinfo`	pointer to structure of type MVI69MODULEINFO

Description

MVI69_SetModuleInfo sets the identity information for the module. This function must be called before MVI69_Open. The module indentity is provided in the structure modinfo. *handle* must be a valid handle returned from MVI69_Open. The MVI69MODULEINFO structure is defined as:

```
typedef struct tagMVIBPMODULEINFO
{
     WORD  VendorID;        /* Reserved */
     WORD  DeviceType;      /* Reserved */
     WORD  ProductCode;     /* Device model code */
     BYTE  MajorRevision;   /* Device major revision */
     BYTE  MinorRevision;   /* Device minor revision */
     DWORD SerialNo;        /* Serial number */
     BYTE  Name[32];        /* Device name (string) */
}  MVI69MODULEINFO
```

The module serial number is set during manufacturing and cannot be edited.

Return Value

`MVI69_SUCCESS`	the module information was read successfully
`MVI69_ERR_NOACCESS`	`handle` does not have access

Example

```
MVI69HANDLE        handle;
MVIBPMODULEINFO   modinfo;

/* Setup a customized module identity */
char new_name[] = "Widget 6900";
strcpy (modinfo.Name, new_name);
modinfo.VendorID = 774;
modinfo.DeviceType = 30;
modinfo.ProductCode = 42;
modinfo.MajorRevision = 2;
modinfo.MinorRevision = 1;
MVI69_SetModuleInfo (0, &modinfo);
/* Now open the API (and initialize backplane comms with new ID) */
MVI69_Open (&Handle);
```

See Also

MVI69_GetModuleInfo

MVI69_GetScanMode

Syntax

```
int MVI69_GetScanMode (MVI69HANDLE handle,int *mode);
```

Parameters

`handle`	handle returned by previous call to MVI69_Open
`mode`	pointer to a variable that will be updated with the current processor mode

Description

This function is used to query the state of the processor.

handle must be a valid handle returned from MVI69_Open.

mode is a pointer to an integer. When this function returns, this will be set to indicate the current processor status and shown in the following table:

Name	**Description**
MVI69_RUN_MODE	Set if processor is in Run mode.
MVI69_PROGRAM_MODE	Set if processor is in Program Mode.

Return Value

`MVI69_SUCCESS`	no errors were encountered
`MVI69_ERR_NOACCESS`	`handle` does not have access

Example

```
MVI69HANDLE        handle;
int                status;

MVI69_GetProcessorStatus (handle, &status);
if (status == MVI69_RUN_MODE)
  //Processor is in Run Mode
else
  //Processor is not in Run Mode
```

MVI69_GetScanCounter

Syntax

```
int MVI69_GetScanCounter (MVI69HANDLE handle,DWORD *count);
```

Parameters

`handle`	handle returned by previous call to MVI69_Open
`count`	pointer to a variable that will be updated with the current scan count

Description

This function returns the current scan counter. The scan counter is a 32-bit counter that is incremented with each backplane scan.

handle must be a valid handle returned from MVI69_Open.

Return Value

`MVI69_SUCCESS`	no errors were encountered
`MVI69_ERR_NOACCESS`	`handle` does not have access

Example

```
MVI69HANDLE        handle;
DWORD              scancount;

MVI69_GetScanCounter (handle, &scancount);
```

MVI69_SetLED

Syntax

```
int MVI69_SetLED (MVI69HANDLE handle,int lednum, int ledstate);
```

Parameters

handle	handle returned by previous call to MVI69_Open
lednum	Specifies which of the user LED indicators is being addressed.
ledstate	Specifies the state to set

Description

MVI69_SetLED allows an application to set the state of the LED indicators.

handle must be a valid handle returned from MVI69_Open.

lednum must be set to MVI69_LEDID_OK, MVI69_LEDID_CFG, MVI69_LEDID_P1, MVI69_LEDID_P2, MVI69_LEDID_BP, or MVI69_LEDID_NET.

ledstate must be set to MVI69_LED_STATE_RED, MVI69_LED_STATE_GREEN, MVI69_LED_STATE_YELLOW, or MVI69_LED_STATE_OFF.

Return Value

MVI69_SUCCESS	the LED state has been set
MVI69_ERR_NOACCESS	handle does not have access
MVI69_ERR_BADPARAM	lednum or ledstate is invalid

Example

```
MVI69HANDLE        handle;

/* OK LED green and NET LED yellow */
MVI69_SetLED(Handle, MVI69_LEDID_OK, MVI69_LED_STATE_GREEN);
MVI69_SetLED(Handle, MVI69_LEDID_NET, MVI69_LED_STATE_YELLOW);
```

MVI69_GetSetupJumper

Syntax

```
int MVI69_GetSetupJumper (MVI69HANDLE handle,int *mode);
```

Parameters

`handle`	handle returned by previous call to MVI69_Open
`mode`	Pointer to an integer that is set to 1 if the Setup Jumper is installed, or 0 if the Setup Jumper is not installed.

Description

This function is used to query the state of the Setup Jumper.

handle must be a valid handle returned from MVI69_Open.

mode is a pointer to an integer. When this function returns, mode will be set to 1 if the module is in setup mode, or 0 if not.

If the Setup Jumper is installed, the module is considered to be in Setup Mode. If may be useful for an application to detect Setup Mode and perform special configuration or diagnostic functions.

Return Value

`MVI69_SUCCESS`	no errors were encountered
`MVI69_ERR_NOACCESS`	`handle` does not have access

Example

```
MVI69HANDLE        handle;
int                mode;

MVI69_GetSetupMode (handle, &mode);
if (mode)
    // Setup jumper is installed - perform configuration/diagnostic
else
    // Not in Setup Mode - normal operation
```

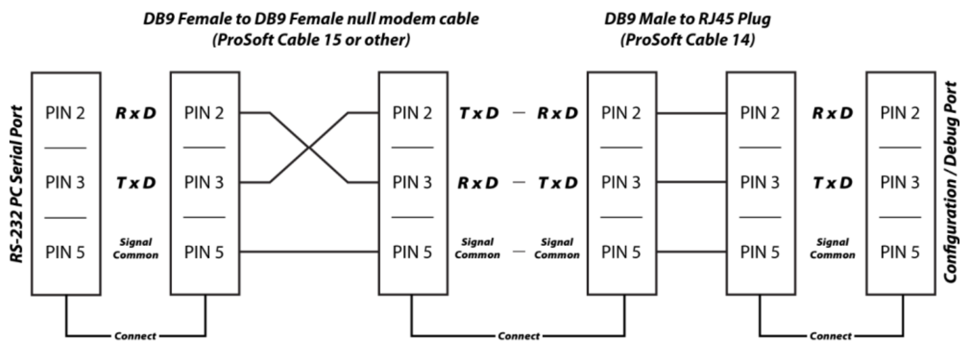
6 Cable Connections

The application ports on the MVI69E-LDM module support RS-232, RS-422, and RS-485 interfaces. Please inspect the module to ensure that the jumpers are set correctly to correspond with the type of interface you are using.

Note: When using RS-232 with radio modem applications, some radios or modems require hardware handshaking (control and monitoring of modem signal lines). Enable this in the configuration of the module by setting the *UseCTS* parameter to 1.

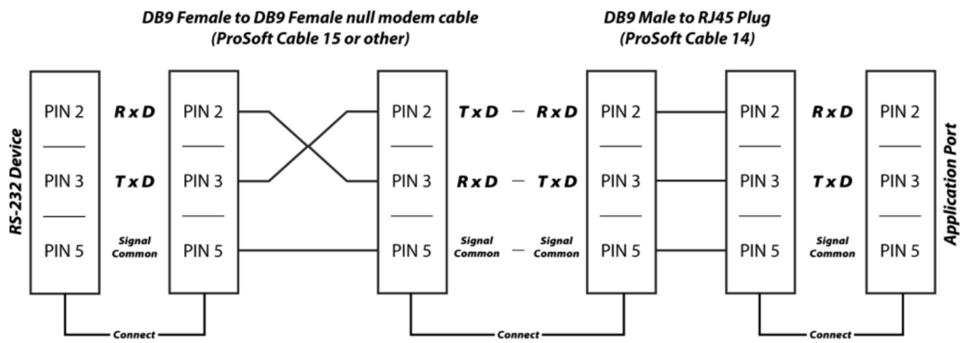
6.1 RS-232 Configuration/Debug Port

This port is physically an RJ45 connection. An RJ45 to DB-9 adapter cable is included with the module. This port permits a PC-based terminal emulation program to view configuration and status data in the module and to control the module. The cable pinout for communications on this port is shown in the following diagram.



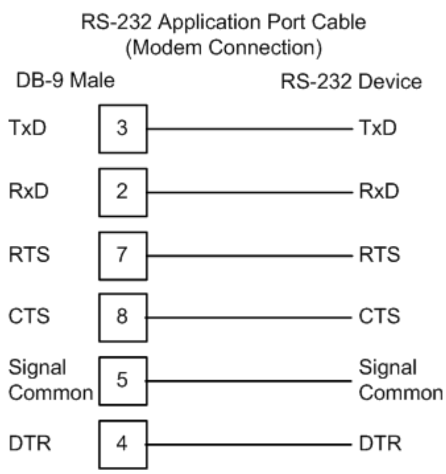
6.2 RS-232 Application Port(s)

When the RS-232 interface is selected, the use of hardware handshaking (control and monitoring of modem signal lines) is user definable. If no hardware handshaking will be used, here are the cable pinouts to connect to the port.



6.2.1 RS-232: Modem Connection (Hardware Handshaking Required)

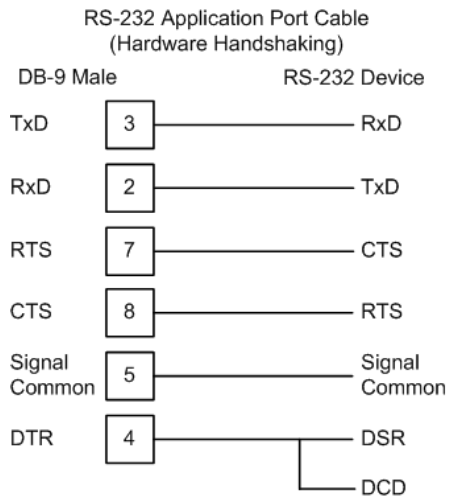
This type of connection is required between the module and a modem or other communication device.



The *Use CTS Line* parameter for the port configuration should be set to **Y** for most modem applications.

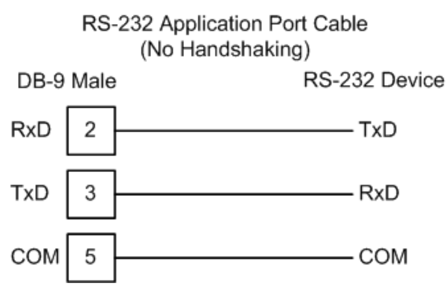
6.2.2 RS-232: Null Modem Connection (Hardware Handshaking)

This type of connection is used when the device connected to the module requires hardware handshaking (control and monitoring of modem signal lines).

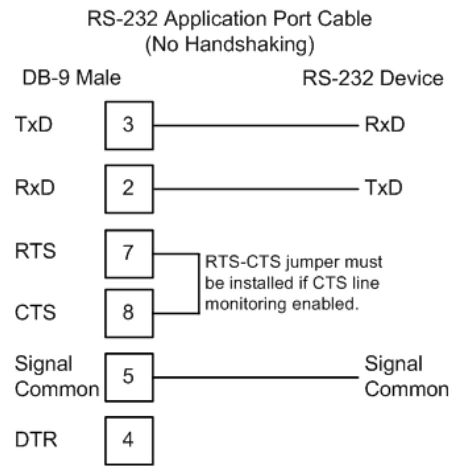


6.2.3 RS-232: Null Modem Connection (No Hardware Handshaking)

This type of connection can be used to connect the module to a computer or field device communication port.

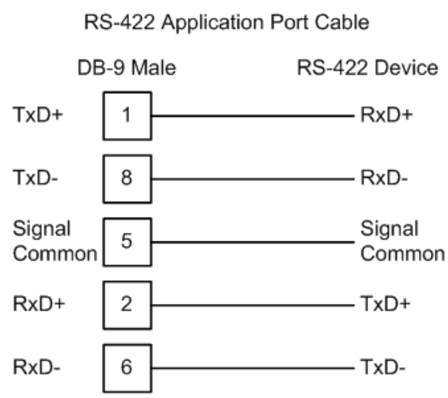


Note: For most null modem connections where hardware handshaking is not required, the *Use CTS Line* parameter should be set to **N** and no jumper will be required between Pins 7 (RTS) and 8 (CTS) on the connector. If the port is configured with the *Use CTS Line* set to **Y**, then a jumper is required between the RTS and the CTS lines on the port connection.



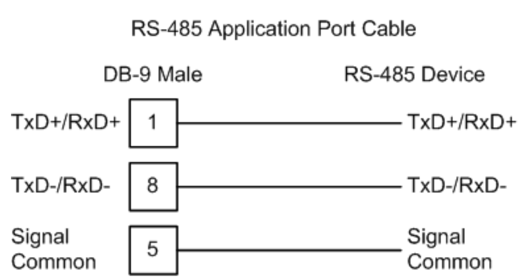
6.3 RS-422

The RS-422 interface requires a single four or five wire cable. The Common connection is optional, depending on the RS-422 network devices used. The cable required for this interface is shown below:



6.4 RS-485 Application Port(s)

The RS-485 interface requires a single two or three wire cable. The Common connection is optional, depending on the RS-485 network devices used. The cable required for this interface is shown below:

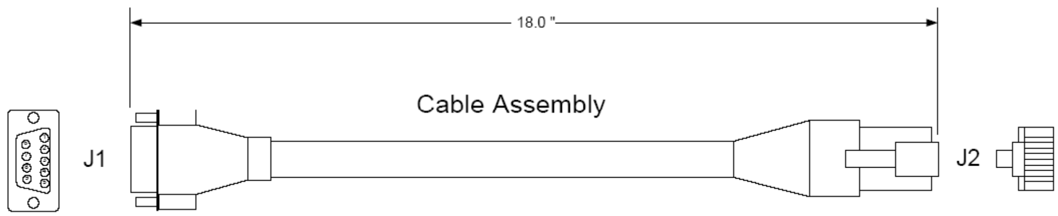


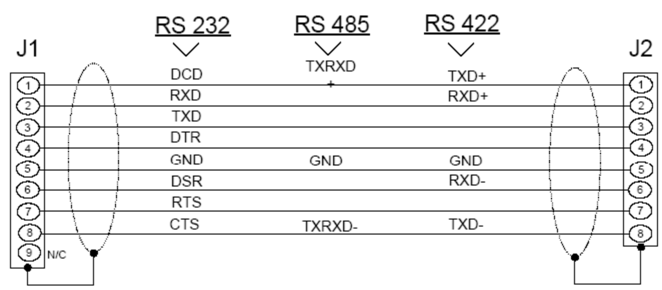
Note: Terminating resistors are generally not required on the RS-485 network, unless you are experiencing communication problems that can be attributed to signal echoes or reflections. In these cases, installing a 120-ohm terminating resistor between pins 1 and 8 on the module connector end of the RS-485 line may improve communication quality.

6.4.1 RS-485 and RS-422 Tip

If communication in the RS-422 or RS-485 mode does not work at first, despite all attempts, try switching termination polarities. Some manufacturers interpret + and -, or A and B, polarities differently.

6.5 DB9 to RJ45 Adaptor (Cable 14)





Wiring Diagram

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```
Python 2.5 license
This is the official license for the Python 2.5 release:
A. HISTORY OF THE SOFTWARE
==========================

Python was created in the early 1990s by Guido van Rossum at Stichting
Mathematisch Centrum (CWI, see http://www.cwi.nl) in the Netherlands
as a successor of a language called ABC. Guido remains Python's
principal author, although it includes many contributions from others.
In 1995, Guido continued his work on Python at the Corporation for
National Research Initiatives (CNRI, see http://www.cnri.reston.va.us)
in Reston, Virginia where he released several versions of the
software.
In May 2000, Guido and the Python core development team moved to
BeOpen.com to form the BeOpen PythonLabs team. In October of the same
year, the PythonLabs team moved to Digital Creations (now Zope
Corporation, see http://www.zope.com). In 2001, the Python Software
Foundation (PSF, see http://www.python.org/psf/) was formed, a
non-profit organization created specifically to own Python-related
Intellectual Property. Zope Corporation is a sponsoring member of
the PSF.
All Python releases are Open Source (see http://www.opensource.org for
the Open Source Definition). Historically, most, but not all, Python
releases have also been GPL-compatible; the table below summarizes
the various releases.
```

Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes
2.3.1	2.3	2002-2003	PSF	yes
2.3.2	2.3.1	2002-2003	PSF	yes
2.3.3	2.3.2	2002-2003	PSF	yes
2.3.4	2.3.3	2004	PSF	yes
2.3.5	2.3.4	2005	PSF	yes
2.4	2.3	2004	PSF	yes
2.4.1	2.4	2005	PSF	yes
2.4.2	2.4.1	2005	PSF	yes
2.4.3	2.4.2	2006	PSF	yes
2.5	2.4	2006	PSF	yes

```
Footnotes:

(1) GPL-compatible doesn't mean that we're distributing Python under
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    other software that is released under the GPL; the others don't.

(2) According to Richard Stallman, 1.6.1 is not GPL-compatible,
    because its license has a choice of law clause. According to
    CNRI, however, Stallman's lawyer has told CNRI's lawyer that 1.6.1
    is "not incompatible" with the GPL.

Thanks to the many outside volunteers who have worked under Guido's
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Version 3.1, 31 March 2009

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3. Network details

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9 Glossary of Terms

A

API

Application Program Interface

B

BIOS

Basic Input Output System. The BIOS firmware initializes the module at power up, performs self-diagnostics, provides a DOS-compatible interface to the console, and flashes the ROM disk.

Byte

8-bit value

C

CIP

Control and Information Protocol. This is the messaging protocol used for communications over the CompactLogix backplane. Refer to the ControlNet Specification for information.

Connection

A logical binding between two objects. A connection allows more efficient use of bandwidth, because the message path is not included after the connection is established.

Consumer

A destination for data.

Controller

The PLC or other controlling processor that communicates with the module directly over the backplane or via a network or remote I/O adapter.

D

DLL

Dynamic Linked Library

E

Embedded I/O

Refers to any I/O which may reside on a CAM board.

ExplicitMsg

An asynchronous message sent for information purposes to a node from the scanner.

H

HSC

High Speed Counter

I

Input Image

Refers to a contiguous block of data that is written by the module application and read by the controller. The input image is read by the controller once each scan. Also referred to as the input file.

L

Library

Refers to the library file containing the API functions. The library must be linked with the developer’s application code to create the final executable program.

Linked Library

Dynamically Linked Library. See Library.

Local I/O

Refers to any I/O contained on the CPC base unit or mezzanine board.

Long

32-bit value.

M

Module

Refers to a module attached to the backplane.

Mutex

A system object which is used to provide mutually-exclusive access to a resource.

O

Originator

A client that establishes a connection path to a target.

Output Image

Table of output data sent to nodes on the network.

P

Producer

A source of data.

PTO
Pulse Train Output

PTQ Suite
The PTQ suite consists of line products for Schneider Electronics platforms: Quantum (ProTalk)

S

Scanner
A DeviceNet node that scans nodes on the network to update outputs and inputs.

T

Target
The end-node to which a connection is established by an originator.

Thread
Code that is executed within a process. A process may contain multiple threads.

W

Word
16-bit value