*Uni*ROM

User's Manual

v2.2 7/1/97

TechTools

Introduction

Thank you for purchasing a quality TechTools product! We firmly believe in providing high quality, cost effective tools and support. If you have any problems, questions or suggestions, we would be happy to hear from you.

UniROM, a Brief Overview

*Uni*ROM is a very unique product. It speeds up the firmware development process in several ways. In its simplest configuration, *Uni*ROM provides very plug-n-play EPROM Emulation. With minimal additional effort, *Uni*ROM provides advanced Memory Emulation with target write-back, real-time watches and dual-ported read/write access to emulation memory. In Advanced configurations, *Uni*ROM enhances debug monitors and software debuggers with Virtual UARTS, Virtual Console Paths and *Uni*ROM Debugger eXtensons (UDXs).

Figure 1 identifies *Uni*ROM's major connectors, controls and status indicators. Following the diagram is a complete description of each item.

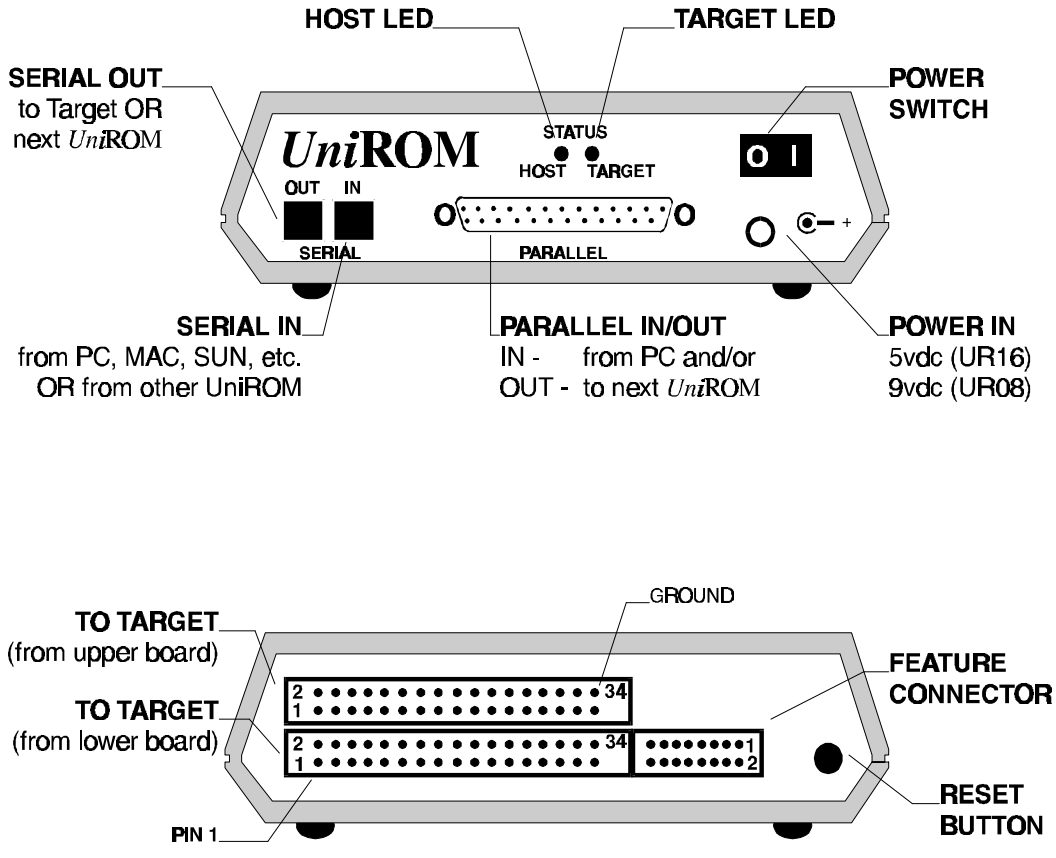


Figure 1 - Connectors, Controls and Status Indicators

Feature Descriptions

Power Switch

Master power switch for *Uni*ROM. Turning this switch to the OFF position (the '0' side of the rocker depressed) kills ALL power to *Uni*ROM.

Power Connector

Power input to *Uni*ROM. 8 bit *Uni*ROMs use an external, unregulated DC power transformer in the 8 to 9 VDC range. 16 bit *Uni*ROMs use an external 5VDC regulated power supply.

Parallel Port

*Uni*ROM's parallel interface is designed to operate with all IBM PC compatible printer port interfaces. However, it does NOT follow standard Centronics handshaking protocols (it does NOT look like a printer). In particular, *Uni*ROM sends data back to the HOST through the status lines, a nibble at a time while in NIBBLE mode, allowing bi-directional communications with standard PC printer port cards. While in BYTE mode, *Uni*ROM sends data back to the PC a byte at a time across the printer data lines.

Serial IN

*Uni*ROM's serial IN port is configured as a standard RS-232 DCE port (like a modem) and operates at any standard BAUD rate between 1200 and 115.2Kbaud. It uses RTS/CTS hardware handshaking to allow full bandwidth communications with slow HOSTs.

Serial OUT

UniROM's serial OUT connector is configured as a standard RS-232 DTE port (like a PC) and operates at the same BAUD RATE as the serial IN port. It also uses RTS/CTS hardware handshaking. Its primary purpose is to allow serial daisy-chaining of multiple *Uni*ROMs. It can also be used as a console path to the target.

Target Status LED

The TARGET status LED will turn ON anytime *Uni*ROM senses power on the target interface connector. It will blink OFF to indicate that *Uni*ROM is sensing target accesses to its emulation memory.

HOST Status LED

The HOST status LED turns ON whenever power is applied to *Uni*ROM. It blinks off each time it receives a character from the HOST or it sends a character to the HOST. If multiple *Uni*ROMs are daisy-chained together, the HOST status LED of the SELECTED *Uni*ROM will be the only one that blinks.

RESET

Pressing the RESET button resets *Uni*ROM and the target. If a CONSOLE path is defined, *Uni*ROM will automatically re-establish the CONSOLE path at the configured BAUD-RATE after each reset.

Feature Connector

The feature connector provides access to several extra interface signals including RESET, INTERRUPT control outputs and status inputs. These signals are documented in Appendix B.

Target Interface Connector

This connector connects to the target's memory socket through a target interface cable.

16 bit *Uni*ROMs have two target interface connectors. 8 bit *Uni*ROMs have only one connector.

Using this manual

We designed many advanced, complex features into *Uni*ROM, resulting in a large number of configuration items. Our overall philosophy is to give our users as much control and flexibility as possible. However, we realize that it is equally important that the product is immediately usable and that the advanced features do not interfere with basic operating modes. We have taken several steps to accomplish BOTH goals.

FIRST, we designed *Uni*ROM to provide logical defaults to all configuration items.

SECOND, we designed the software and firmware so that you only need to specify the parameters you wish to change. This allows you to ignore the configuration of items that you are not using.

THIRD, we organized the manual into four distinct sections. Chapters 1 through 3 deal with basic installation, operation and concepts. Chapter 4 presents a functional block diagram of *Uni*ROM and then discusses each block. The middle chapters document more advanced concepts and the last chapters provide complete detailed documentation of the features.

In previous releases we provided complete, detailed information early in the manual to avoid discussing topics that had not been defined. We received considerable feedback that people got lost in the details and had difficulty extracting the basic concepts. In this release, we defer the details to the end of the manual to help eliminate unnecessary "information overload". We avoid forward referencing material in the last chapters as much as possible by providing basic descriptions of items as they are introduced. This results some redundancy, but should make the manual more user-friendly.

Problems, Comments and Suggestions

Please feel free to contact us with any comments or suggestions for product improvements or additions. We always welcome such feedback from our customers. We use this information to continually improve our product line to meet your current and future Embedded Development needs.

We are equally interested in hearing about any problems, bugs or other issues you encounter. These Tech-Support issues help us to clarify our documentation and to make our software more user friendly.

How to Contact Us

You can contact us with problems, questions or suggestions through any of the following methods:

Voice:	(972) 272-9392	9:00 to 5:00 CST Monday through Friday
FAX:	(972) 494-5814	On-line 24 hours
Web:	http://tech-tools.com	On-line 24 Hours
email:	support@tech-tools.com	Checked at least twice Daily

Chapter 1: Getting Started

The following sections concentrate on PC platforms. Refer to the Chapters on the ASCII Mode Interface (11) and NON-PC Support (12) for addition information on using *Uni*ROM on other HOST platforms.

*Uni*ROM ships with two DOS based programs for PCs, URTERM.EXE and URLOAD.EXE. These programs are written for DOS but operate well in a DOS box under Windows. URTERM is discussed in Chapter 10.

We will use URLOAD.exe for the initial startup. It is our primary interface to *Uni*ROM and will probably be your tool of choice. URLOAD allows us to ignore more advanced configuration items until they are needed, making it possible to establish a consistent baseline. Once we have established communications and verified *Uni*ROM functionality, you may choose to explore URTERM.exe and the ASCII interface.

URLoad is a batchable, script driven loader that provides full control over all aspects of *Uni*ROM's operation. We provide script commands for full configuration, control, status and file loads, verifies and saves through either a Serial or Parallel port connection. This provides completely automatic, batchable operations. URLoad supports all common BAUD rates from 1200 to 115K on a Serial port and over 70KBYTEs/sec. throughput on a Parallel port connection.

Getting started consists of the following three steps:

1. Installing the Software
2. Connecting *Uni*ROM to one of your HOST ports.
3. Verifying the setup

Each of these steps is covered below.

Software Installation

There are no special installation requirements. The distribution files are not compressed or copy-protected. Simply create a working directory on your hard disk and copy the distribution files into that directory. Put the master distribution diskette in a safe place. You may make a back-up copy of the diskette to protect yourself in the event it should become damaged. If your diskette is unreadable or otherwise damaged, call our Technical Support group for replacements.

Host Port Connections

*Uni*ROM supports both a Serial HOST connection and a Parallel HOST connection. PC HOSTs may use either (or both) for HOST communications with *Uni*ROM.

Determine which type of port you wish to use and connect *Uni*ROM to the HOST as shown in Figures 2 or 3 below.

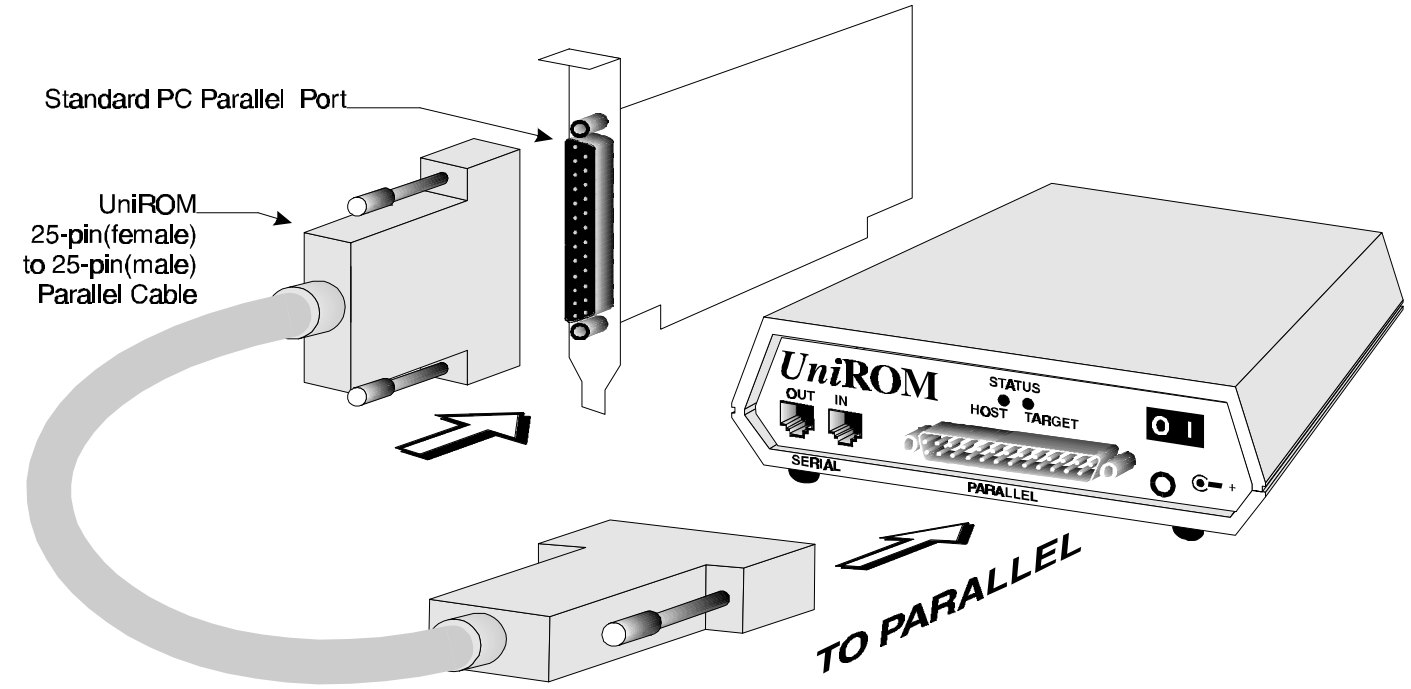


Figure 2 Parallel HOST Connections

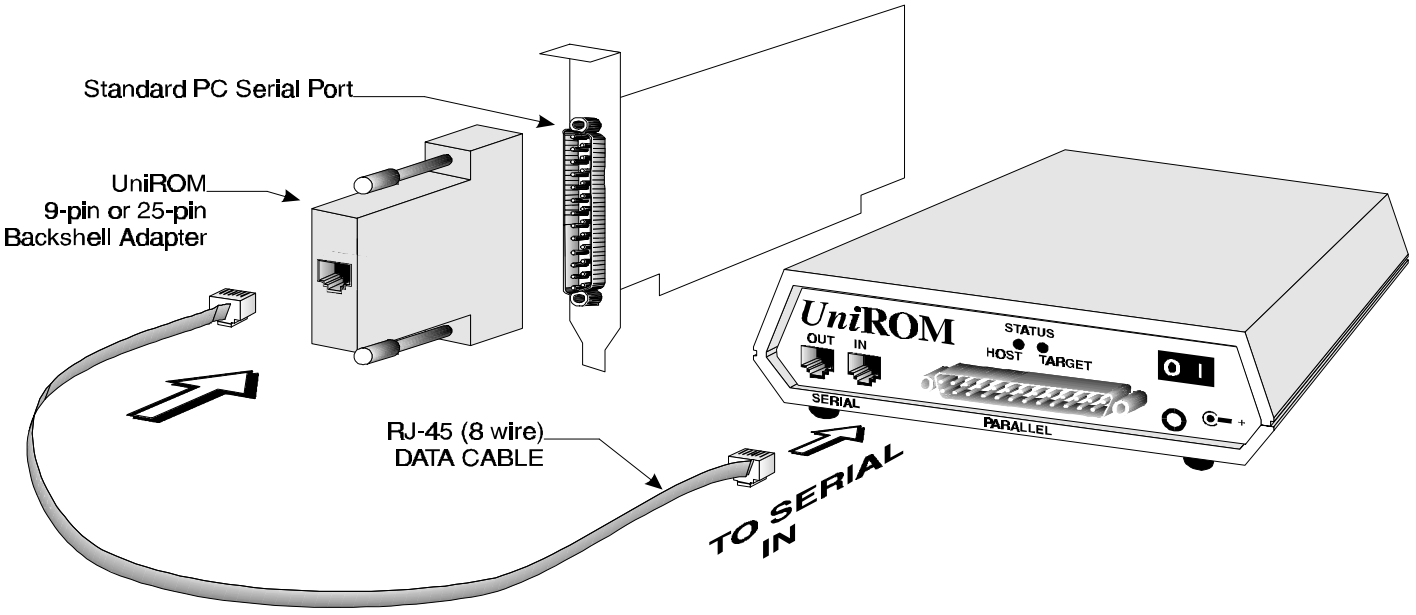


Figure 3 Serial HOST Connections

System Verification

Before connecting *Uni*ROM to your target, we can verify that the HOST is communicating correctly with *Uni*ROM by doing a basic memory test on *Uni*ROM.

We can do this by loading a test file into *Uni*ROM's emulation memory and verifying it. You should find a data file called DATA64.TST and a script file called TEST.CFG in your working directory. To load and verify this file, you will need to edit the TEST.CFG file to tell the *Uni*ROM tools which HOST port you want to use. This is accomplished by editing the "PORT" line as follows:

The general syntax for the PORT line is:

```
PORT   [port#]   [BAUDRATE]  [INTERRUPT]
```

You can specify the port number by LOGICAL DEVICE NAME (COM1-4 or LPT1-3) or by the port's physical address. If you specify the port by its address, precede the port address with an 'S' if it is a SERIAL port or by 'P' if it is a parallel port. In addition, SERIAL port definitions require a BAUD-RATE parameter and optionally an interrupt number. The following examples should help:

```
PORT   COM2    115200        // com2 at 115200 BAUD, default IRQ for com2
PORT   COM1    19200   15    // com1 at 19200 BAUD, use IRQ 15
PORT   S3F8    57600   4     // Serial port at 0x3f8, 57600 BAUD, IRQ 4
PORT   LPT1                  // Use LPT1 (as reported by BIOS tables)
PORT   P278                  // parallel port at 0x278
PORT   LPT3                  // Use LPT3 (as reported by BIOS tables)
```

valid port#: LPT1,LPT2,LPT3,COM1,COM2,COM3,COM4,Sxxx,Pxxx
Common PARALLEL port addresses: 0x378, 0x278 and 0x3BC
Common SERIAL port addresses: 0x3f8, 0x2f8, 0x3e8 and 0x3e8

valid BAUD-RATES: 1200,2400,4800,9600,19200,38400,57600,115200
valid interrupts: 2-15

You normally would NOT specify an interrupt unless you know that you have a custom serial port with a custom IRQ configuration or you used the Sxxx format to specify the serial port address.

SELECTING THE WRONG INTERRUPT MAY "LOCK-UP" THE PC.

After editing this line, save the file and invoke the script as follows:

```
URLOAD   TEST.CFG
```

If the PORT line accurately describes which port is connected to *Uni*ROM, the script will load and verify the test file. If you receive any error messages about the port not being found or *Uni*ROM not responding, verify the following:

- *Uni*ROM is turned ON.
- All cables are connected and tight.
- *** The PORT line is accurate. ***
- No drivers or TSRs are loaded that may be trying to access the selected port.
- If using a PARALLEL PORT, verify that the port is in "standard" or "compatible" mode. Do NOT use "enhanced, EPP or ECP" modes

- Verify that NO print spoolers are trying to drive the selected port.
- Remove any cable extensions, switch boxes or security keys from *Uni*ROM's cable.
- The selected port is not powered-down or disabled by some power-saving mode on the PC.
- The selected port EXISTS in the PC. You can verify which ports are available to you by running MSD.exe. MSD.exe is provided by Microsoft with Windows and DOS.

If the error persists, try resetting *Uni*ROM or using a different port on the PC.

If you are get to this point and have not been able to successfully load and verify the test file, call or FAX our Technical Support group for help.

Chapter 2: Target Connections

Connecting *Uni*ROM to the target consists of plugging the target interface cable into your target's memory socket and connecting a micro-clip wire to the target's RESET circuit.

All *Uni*ROMs ship with a 28 pin DIP cable for connection to 512Kbit and smaller DIP devices. Larger *Uni*ROMs also include a 32 pin DIP cable for connection to larger DIP device sockets. 16 bit *Uni*ROMs ship with two sets of cables. Determine the type of memory socket used on your target and refer the appropriate section below.

Don't miss the section on RESET line connections at the end of this chapter.

28 or 32 pin DIP Memory Socket

Select the 28 pin target cable if your target uses 28 pin DIP sockets. Of course the 32 pin cable is for targets with 32 pin DIP sockets. Plug the 34 pin header end of the cable into *Uni*ROM. This connector is polarized, making it nearly impossible to plug in backwards.

Plug the DIP end of the cable into your target memory socket, being careful to align the cable's PIN1 indicator with the target socket's pin 1 as shown in Figure 4 below.

PLUGGING THE CABLE INTO THE TARGET SOCKET BACKWARDS <u>WILL</u> DAMAGE *Uni*ROM OR THE TARGET!

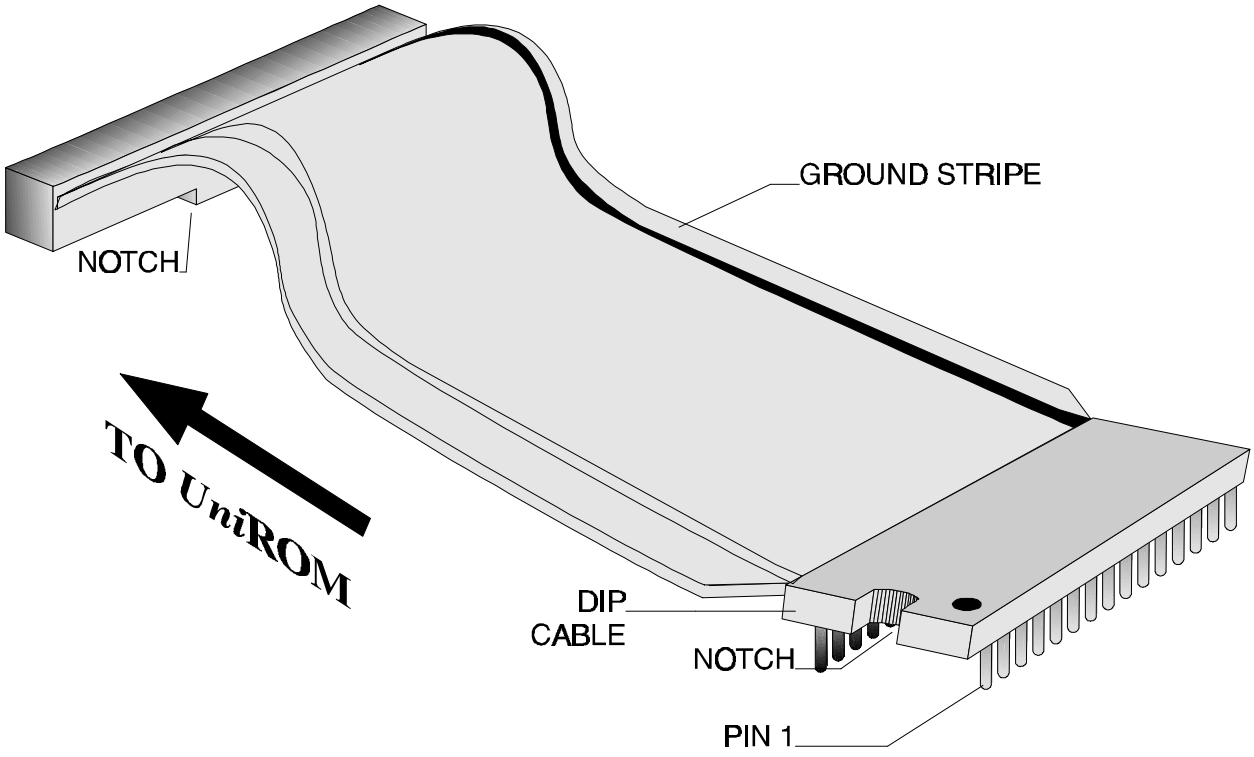


Figure 4 - 28 or 32 Pin DIP Connections

32 pin PLCC Memory Socket

If your target uses a PLCC socket, you will need a DIP to PLCC adapter between the cable and the socket as shown in Figure 5. NOTE that PLCC adapters come two different pin-outs. Be sure to order the correct adapter to match YOUR TARGET SOCKET'S WIRING. TechTools offers PLCC adapters for both configurations. Use the following guidelines to determine which one is correct for your target.

If the target is wired for 8 bit EPROMS smaller than 1Mbit (2764-27512), use ADP28.
For 1Mbit (27010) and larger 8 bit EPROMs, use ADP32.
For ALL 8 bit FLASH devices, use ADP32.

PLUGGING THE CABLE or ADAPTERS INTO THE TARGET SOCKET BACKWARDS WILL DAMAGE *Uni*ROM OR THE TARGET!

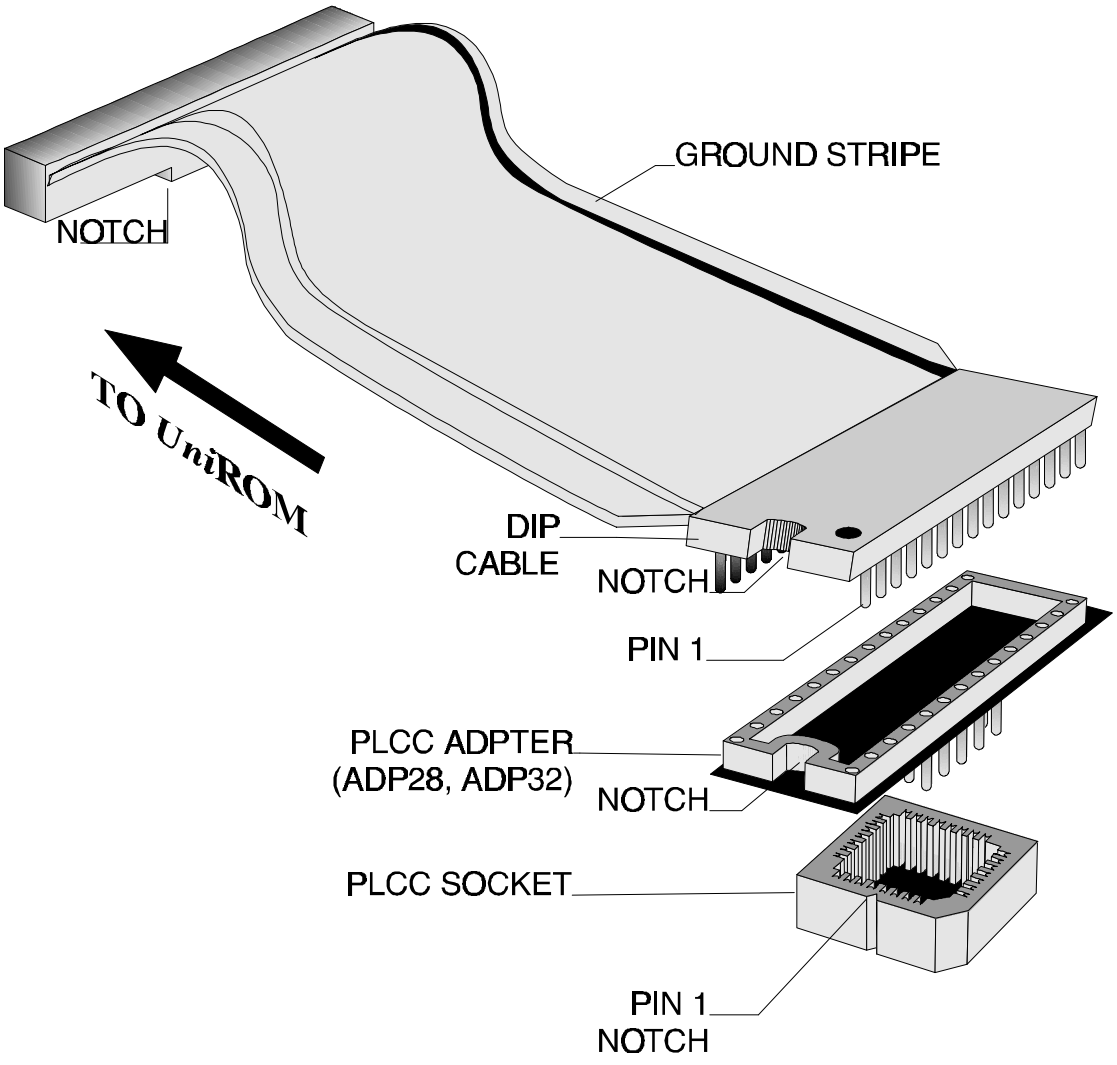


Figure 5 - 32 pin PLCC Connections

40 pin DIP Memory Socket

40 pin DIP sockets are for 16 bit memory devices (27210,271024...). If you wish to emulate these devices, you will need a 16 bit *Uni*ROM and an ADP16 adapter. These are connected as shown in Figure 6 below.

PLUGGING THE CABLE or ADAPTERS INTO THE TARGET SOCKET BACKWARDS <u>WILL</u> DAMAGE *Uni*ROM OR THE TARGET!

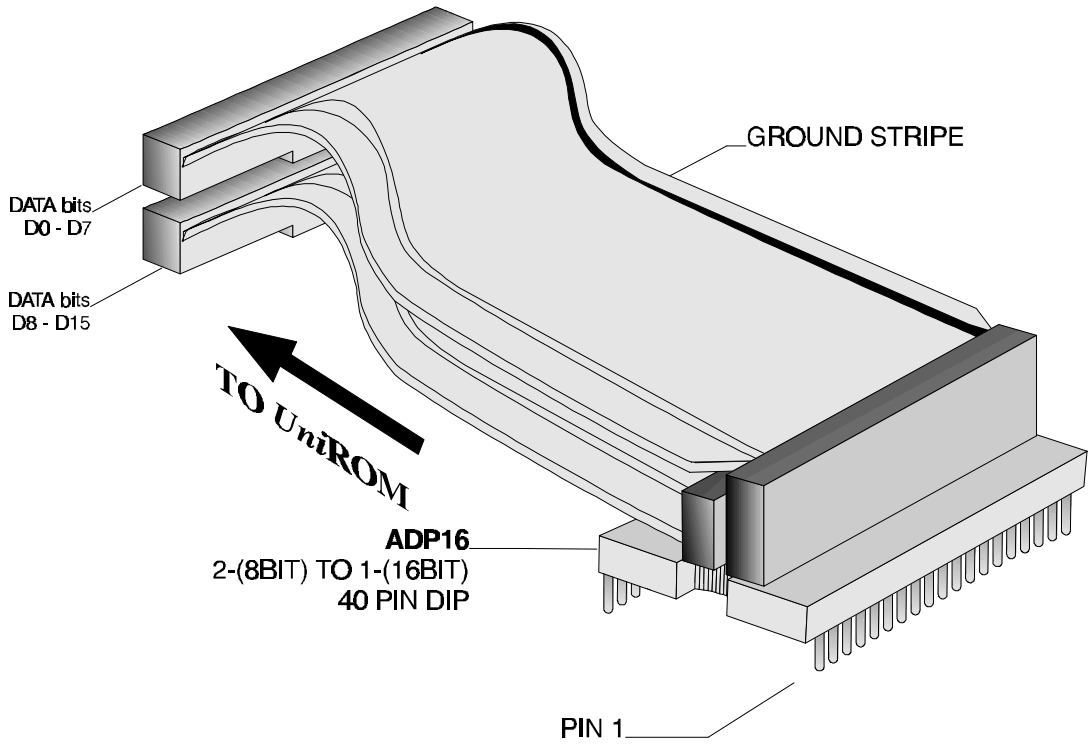


Figure 6 - 40 pin DIP Connections

44 pin PLCC Memory Socket

44 pin PLCC sockets are for 16 bit memory devices (27210,271024...). If you wish to emulate these devices, you will need a 16 bit *Uni*ROM, an ADP16 and an ADP40. These are connected as shown in figure 7 below.

PLUGGING THE CABLE or ADAPTERS INTO THE TARGET SOCKET BACKWARDS <u>WILL</u> DAMAGE *Uni*ROM OR THE TARGET!

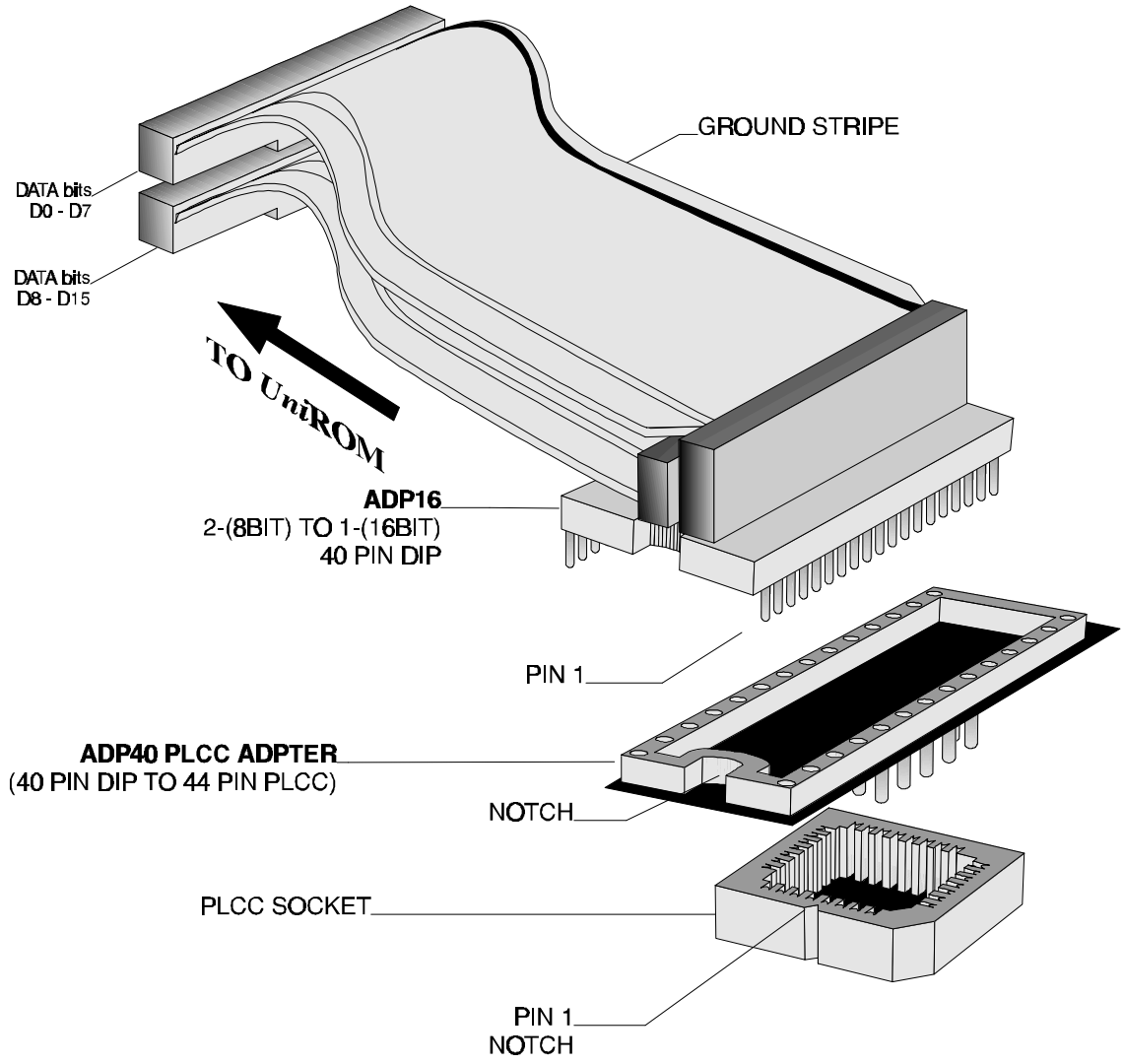


Figure 7 - 44 pin PLCC Connections

Reset

Connect one of the supplied micro-hook connectors between the RESET pin on *Uni*ROM's feature connector (PIN 5) and your target's reset circuitry. Refer to Appendix B for the feature connector pin-out. You will aslo find this information on the bottom of the *Uni*ROM. It is important that the reset line be connected at an appropriate point on the target. The Reset line defaults to a tri-state driver, ideal for connecting across the RC reset circuitry or reset switch input found on most CPU boards.

DO NOT CONNECT THE RESET LINE ACROSS THE OUTPUT OF A BI-POLAR (Totem-Pole) LOGIC GATE.

This would put *Uni*ROM's driver in contention with the target's driver, possibly resulting in damage to either one.

Some circuits will use a watch-dog/reset chip to drive the target board's reset. These chips usually use an RC circuit on an input pin to initiate the reset. This pin would be an appropriate connection point. Other chips will drive the circuit reset with an open-collector driver. It would be safe to connect the reset line across this driver if the reset driver is configured for Active-LOW, Tri-state. If you are in doubt, FAX us a copy of your reset circuitry and we would be happy to make specific recommendations.

Chapter 3: Basic Configuration and Use

URLOAD uses script files to configure the HOST port, configure *Uni*ROM and to execute a series of commands. In Chapter 1, we edited a script file (test.cfg) to tell URLOAD which HOST port to use for *Uni*ROM communications. The remainder of the script was preset to configure *Uni*ROM for the test file and to load and verify that file.

Your working directory contains another script file called "UNIROM.CFG". This is the default script that is used if you invoke URLOAD without specifying a script file name. You may modify this file to reflect your current configuration, or copy it to another file name and then edit it.

Usually, one will create a single script for a given project and save it as "UNIROM.CFG" in that project's working directory. You can create several different script files and then invoke the desired one with a command line parameter to URLOAD. NOTE that a single script file can perform multiple operations. It is possible to execute any mix of load, save, verify, ...etc. commands in a single script file. These commands are executed in the order they are encountered in the COMMAND section of the script, giving you full control over the sequence of events.

Basic Configuration Concepts

All Script files have three sections; HOST, CONFIGURATION and COMMAND. Each section is discussed below.

HOST Section

The HOST section contains a single item, the PORT definition. This item tells the loader which HOST port to use and how to configure it. You should set this line to the same values used in Chapter 1 for the setup verification.

This section MUST be the first section in the file. All lines before the PORT definition are ignored.

CONFIGURATION Section

This section consists of *Uni*ROM configuration information. It tells the loader how to configure *Uni*ROM's parameters for this target environment. This configuration information is loaded into *Uni*ROM before the COMMAND section is executed.

Any parameters not specified in this section will assume their default settings.

This section MUST come before the COMMAND section.

COMMAND Section

This section contains one or more commands to *Uni*ROM. These commands are executed in order, allowing one to exercise full control over *Uni*ROM.

The first line in the configuration section is usually "RESET ON". This line tells *Uni*ROM to assert RESET to the target to prevent it from doing stupid things while we change its code space.

A Basic Script File

The following is a re-print of the default UNIROM.CFG supplied on the distribution diskette and a description of the purpose of each line.

```
[HOST]                          // Marks beginning of HOST section
PORT  LPT2                      // Use Parallel port LPT2

[CFG]                           // Marks the beginning of configuration section
DEVICE  64  E0000  EPROM        // Emulating a 64KByte EPROM at address 0xf0000
RESET  HI  TRI-STATE            // Reset is active HIGH with a tri-state driver

[CMD]                           // Marks the beginning of the COMMAND section
RESET ON                        // Activate RESET
LOAD   BIN  myap.bin  E0000     // Load the BINARY file myap.bin at E0000
VERIFY BIN  myap.bin  E0000     // Verify the BINARY file myap.bin against data at E0000
RESET OFF                       // Release RESET
```

Editing UNIROM.CFG

Using the discussion in the previous section as a guide, edit UNIROM.CFG to reflect your environment. The following summarizes the required edits for basic operation:

Edit the PORT definition

This line should be edited to match the one used in Chapter 1 for System Verification.

Edit the DEVICE definition

```
DEVICE   [SIZE]   [ADDRESS]    [TYPE]
```

Edit this line to reflect the memory device *Uni*ROM will be emulating. The first parameter is the device SIZE in decimal KBYTES. The example is set to 64 which would be appropriate if we were emulating a 64KByte device (like a 27C512).

The second parameter is the target's view of the starting address of this device. The example shows a device starting at 0xE0000. This is the real PHYSICAL ADDRESS of the device. This example shows a 64KByte device located at the top of A 1MByte address space (typical for an Intel x86 processor). Bottom-boot processors will usually place this EPROM at the BOTTOM of memory (0).

The third parameter is the device TYPE. This may be EPROM or FLASH corresponding to the device type your target is wired to accept.

Edit the RESET definition

RESET [LEVEL] [DRIVER TYPE]

The first parameter tells us which level (LOW or HIGH) is the ACTIVE state for the RESET line. We will drive the RESET line to this level whenever we get a RESET ON command. This should be set to LOW or HIGH as required by your target's reset circuitry.

The second parameter is the driver TYPE. This can be set to BIPOLAR or TRISTATE, depending on which driver type your target reset circuitry requires.

Edit the LOAD definition

LOAD [FILE TYPE] [NAME] [ADDRESS]

The first parameter is the FILE TYPE. If the source file is in any of the standard formatted HEX formats, set this to HEX. If the file is a raw BINARY image, set this to BIN.

The second parameter is the FILENAME. This is name of the file you wish to load.

The third parameter is the LOAD ADDRESS. For BINARY files, this is the exact address at which you want us to load the file. For HEX files, this the default starting address for the load. Most HEX files contain embedded address information that over-rides this setting. This parameter provides a default for those files that do NOT contain address information. This is usually set to the starting address of the EPROM or of the CODE (if it is higher than the EPROM address).

Edit the VERIFY definition

VERIFY [FILE TYPE] [NAME] [ADDRESS]

These parameters should normally match the LOAD parameters.

You may choose to delete the VERIFY line once you are satisfied that everything is working. The communications between URLOAD and *Uni*ROM follow a strict binary packet protocol. The LOAD command checksums each packet of data that it sends to *Uni*ROM. *Uni*ROM reports any errors in the checksum or any inconsistencies in the protocol. This eliminates any errors due to noise or other communications problems.

Loading files

Once the script file is defined, loading files is as simple as entering "URLOAD" if you used the default name "UNIROM.CFG" for your script file. If you chose a different name for the script, you would type "URLOAD script_name", where script_name is the name of the script file you created.

Normal Operation

Once a script file has been defined that accurately describes your environment and your desired actions, day-to-day operation is very straight-forward and automatic. A typical work scenario would look like this:.

1. Turn PC ON
2. Turn *Uni*ROM ON
3. Turn TARGET ON
4. While (not done)
   - Run URLOAD
   - Observe Results
   - Re-compile changes
5. Turn target OFF
6. Turn *Uni*ROM OFF
7. Turn PC OFF

Power-up/down Sequence

There are no special restrictions on the power-up or power-down sequences other than the target should be the LAST one turned ON and the FIRST one turned OFF. *Uni*ROM monitors the target's power and floats its outputs whenever the target is powered off. This allows one to cycle power on the target at any time without fear of damaging it.

Chapter 4: Architectural Details

The previous chapters covered basic EPROM emulation. We designed several advanced features into *Uni*ROM that allows it to do much more than simple emulation. This chapter discusses *Uni*ROM's architecture. Understanding *Uni*ROM's architecture helps one to envision its potential and to understand how some of the advanced feature work. Figure 8 shows a functional block diagram of *Uni*ROM's architecture. The following sections describe each item shown in the diagram. Some of this information was covered in Chapter 1, but is repeated here for completeness.

Parallel IN/OUT

The PARALLEL port can be connected to a printer port on a PC. URLOAD, URTERM and the *Uni*ROM Libraries can load, control and status *Uni*ROM through this connection.

This port is compatible with standard PC printer ports, BI-DIRECTIONAL printer ports and the newer ECP and EPP ports in standard or bi-directional modes. IT DOES NOT SUPPORT CENTRONICS, EPP or ECP PROTOCOLS.

URLOAD and the *Uni*ROM Libraries can load data at a sustained throughput of 70KBytes/second through this connection. This interface is fully synchronous with full interlocked handshaking, making the system immune to variations in parallel port driver capabilities, capacitive loading and cable length. Weak drivers, excessive loading or excess cable lengths result in slower transfers, rather than data errors.

Serial IN

The SERIAL IN connector serves several purposes. It can be used to load, control and status *Uni*ROM. In addition, it can be used to allow software debuggers or terminal emulation programs to communicate with the target through one of our memory-mapped communications paths or the serial OUT port (see CONSOLE PATHS below).

Serial OUT

The primary purpose of the SERIAL OUT port is to allow DAISY-CHAINING of multiple *Uni*ROMs. A simple straight-through cable can connect the SERIAL OUT port from one *Uni*ROM to the SERIAL IN of the next *Uni*ROM.

The Serial OUT port can also be connected to the target's Serial port. If your target has a spare Serial port, this console path would allow you to interface to the target kernel or monitor without modifications. This is particularly useful if your kernel is already built and functioning through the serial port. *Uni*ROM can simply intercept the serial line and debugging continues as usual.

RESET

The RESET output is a TTL/CMOS compatible output. It can be configured as a BIPOLAR driver or a TRI-STATE driver. It should be connected to the target's RESET circuitry.

*Uni*ROM can reset the target through a script command, a Library function or from an ASCII menu selection. In addition, *Uni*ROM will automatically assert RESET during LOADS and VERIFIES from the ASCII interface if AUTO-RESET is enabled (see the Chapter 12: ASCII Menu Reference).

INTERRUPT

The interrupt output is a TTL/CMOS compatible output. It can be configured as a BIPOLAR driver or a TRI-STATE driver. It is normally connected to the target's interrupt system while using URCOM or VCOM for memory-mapped communications.

*Uni*ROM can interrupt the target through a script command, a Library function or from an ASCII menu selection. In addition, URCOM or VCOM can automatically generate interrupts on RX, TX or BOTH.

To use this feature, simply configure the interrupt driver type and active level with the INTERRUPT definition in a script file or through the Setup\Interrupt ASCII menu. Then connect Pin 4 of the feature connector to your target's interrupt line. Of course the target has to be configured to recognize the interrupt and respond to it. This interrupt would usually be used to get the debug kernels attention.

CONTROL LINES

*Uni*ROM supports four user control lines. These may be individually set or cleared through script commands, Library functions or the Target menu from the ASCII interface. One may use these to stimulate or control the target. No configuration is necessary. Note that these lines are tri-stated when target power drops below 4.0 Volts.

STATUS LINES

*Uni*ROM allows the user to monitor 4 different inputs from the target. These status line may be connected to any TTL or CMOS signals on the target. Their state can be read from script commands, a Library function or viewed from the Target menu in the ASCII interface. No configuration is necessary.

DUAL-PORT MEMORY

*Uni*ROM incorporates a dual-ported memory architecture. This allows full access to the emulation memory without disturbing the target in any way. This feature is used to allow real-time memory watching, memory-mapped communications through VCOM, and real-time memory READS and WRITES while the target is executing out of this same memory space. Chapter 5 describes in detail the arbitration mechanisms used to accomplish this transparency.

VCOM

The CPU within *Uni*ROM manages a memory-mapped Virtual UART called VCOM. VCOM formalizes the use of DUAL-PORTED memory for Target <-> HOST communications. VCOM looks very much like a standard, memory-mapped UART to the target. This makes it very easy to configure most remote monitor or kernel based debuggers to communicate through *Uni*ROM instead of a target serial port, eliminating the need to dedicate target resources for debugging. Chapter 6 describes the target side interface to VCOM in detail.

URCOM

URCOM is a high performance hardware option board. It provides a memory-mapped communications port that does not require WRITE cycles from the target. It interprets a special sequence of reads as a request to send data to the HOST. Eliminating the need for write cycles has several advantages.

First, it guarantees that CONSOLE communication will work, regardless of the target design. *Uni*ROM is plugged into an EPROM or FLASH socket on the target. Some targets are incapable of writing to this space. Decode logic may lock out WRITES to this address space. Some targets will place uni-directional buffers between the EPROM socket and the CPU data bus, making it impossible to WRITE to the socket. Targets with EVEN/ODD interleaved EPROMs will often use a single chip select for BOTH EPROMs, making it impossible to do BYTE level access to the EPROMs. This is reasonable for CODE fetches, but disastrous for WRITEs. URCOM is immune to all of these issues.

Second, it does not rely on arbitrated accesses to emulation memory for proper operation. This allows one to ignore arbitration configuration issues while configuring and testing the console path. It separates the two issues to simplify initial system bring-up.

Third, it operates without a WRITE line, allowing full communications without giving the target WRITE access to the code space. This provides more immunity to code corruption by a run-away application.

All of our debugger support files use the URCOM option.

Refer to the URCOM User's Manual for complete details.

SERIAL MODE SELECT

The SERIAL IN port has several uses. The block diagram illustrates this concept with the "MODE SELECT" switch. This shows that the SERIAL IN port can be "connected" to any one of the following:

- Serial OUT port
- VCOM
- URCOM
- Binary Packet Protocol Interpreter
- ASCII Protocol Interpreter

The first three items are CONSOLE paths. The last two items are command interpreters. Each are discussed below.

CONSOLE PATH

Console Paths manage the SERIAL HOST side access to HOST <-> target communications. The Serial HOST port can be virtually linked to the Serial OUT port, a VCOM connection or the URCOM option board.

Once a CONSOLE path is established, all characters from the SERIAL IN port are transferred to the selected communications port (SERIAL OUT, VCOM or URCOM). All characters from the communications port are transferred to the SERIAL IN port. *Uni*ROM becomes transparent and simply hands-off characters between the two ports.

This mechanism provides a communications path between the HOST and target through *Uni*ROM. Software debuggers, monitor programs and target applications can use this in place of dedicated target hardware.

ESCAPE DETECTION

During CONSOLE connections, *Uni*ROM monitors the serial link for an ESCAPE sequence or a BREAK. Either of these conditions will terminate the CONSOLE connection. A BREAK condition is declared if the SERIAL IN RX line is held at a logic low for more than 10 milliseconds. An ESCAPE sequence is defined by a lack of receive activity for at least 2 seconds, followed by three consecutive '+' characters.

URLOAD and URTERM issue a BREAK when first started to insure that they can communicate with *Uni*ROM.

If you are using a terminal emulator, you can issue a BREAK or send the ESCAPE sequence any time you wish to return *Uni*ROM to COMMAND MODE.

BINARY PACKET PROTOCOL Interpreter

The BINARY PACKET PROTOCOL interpreter is the main interface to *Uni*ROM. It is a very robust protocol with full error checking and recovery mechanisms.

URLOAD and the *Uni*ROM libraries use binary packets to communicate with *Uni*ROM. This interpreter is responsible for receiving, verifying and acting on those packets. As the block diagram shows, this interpreter is available from both the SERIAL and the PARALLEL port interfaces.

The BINARY PACKET PROTOCOL interpreter verifies the checksum on all packets it receives. In addition, it verifies the packet contents to insure that each data in each field is within acceptable ranges for that parameter. For example, if it receives a RESET command packet, it will check that the FLAG parameter is less than 3. Valid values for this parameter are 0 (OFF), 1 (ON) or 2 (PULSE). If any check fails, a failure code is returned to the HOST. Otherwise the command is completed and a result code is returned.

ASCII PROTOCOL Interpreter

The ASCII PROTOCOL Interpreter makes *Uni*ROM compatible with ANY HOST with an RS-232 compatible serial port and a terminal emulation program. The ASCII interface contains all of the intelligence necessary to display menus and interpret commands from the user. This permits the use of simple terminal emulators on the HOST and eliminates the need for any dedicated HOST software.

In PC environments, one can use URTERM to access the ASCII interface from a SERIAL or a PARALLEL port. In addition, ALL HOSTs (including PCs) can use their favorite terminal emulator on the SERIAL port interface.

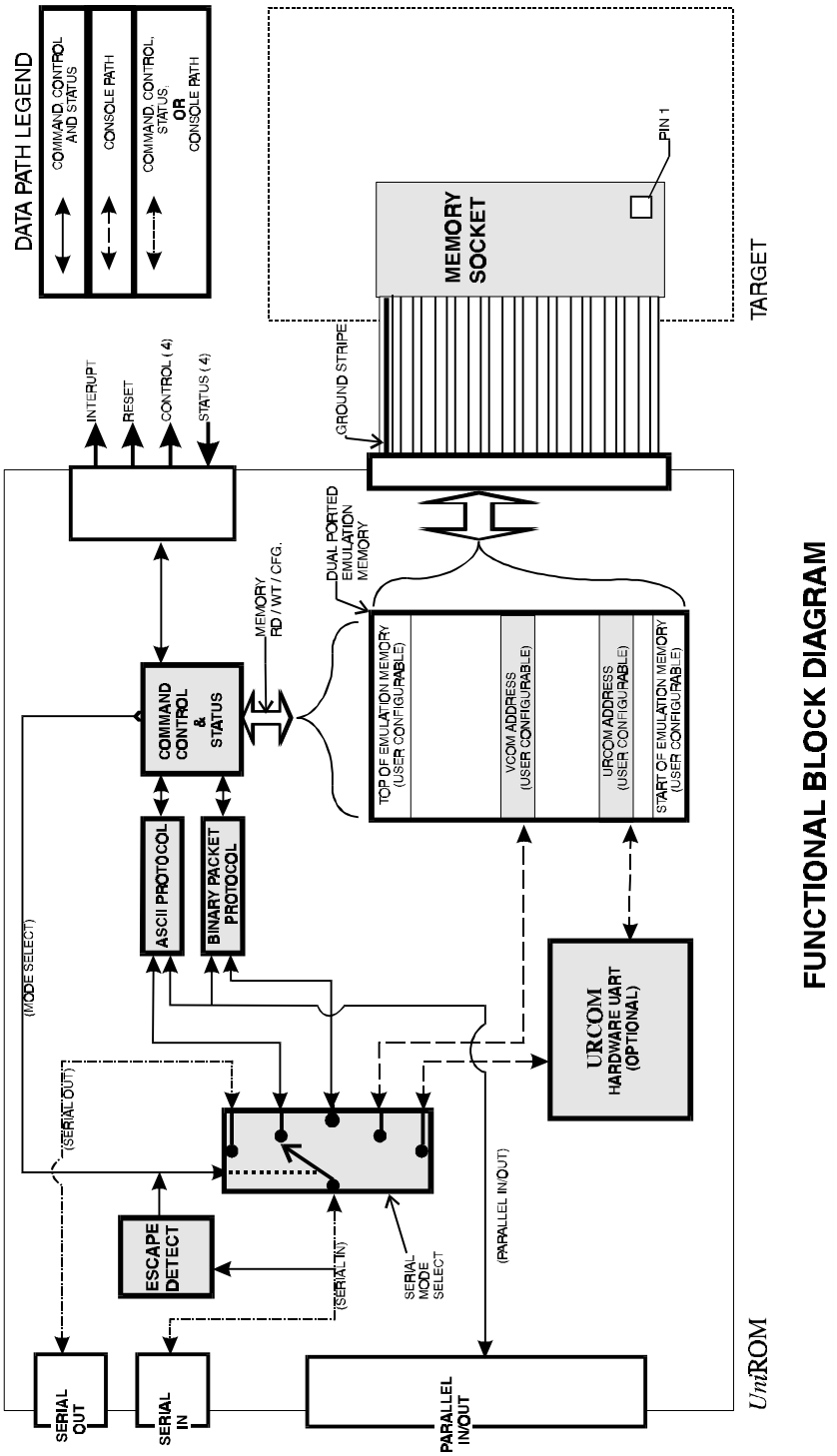


Figure 8 - Functional Block Diagram

Chapter 5: Arbitration

The key to advanced configurations is ARBITRATION. Arbitration allows *Uni*ROM AND the target to access the emulation memory simultaneously. This capability is used to allow memory watching, reading and writing while the target is executing from this same memory. It is also used to enable VCOM communications. We designed *Uni*ROM to transparently arbitrate in virtually ALL targets without imposing cycle time restrictions, inserting wait-states or depending on the target's arbiter.

*Uni*ROM's primary arbitration mechanism is called Bank Shadowing. This method works in all but a very few situations. Basically, **Bank Shadowing works as long as the target regularly accesses its memory**. As you would expect, this represents virtually ALL embedded systems. However, there are a few cases in which this would not be true. The other four arbitration methods are provided to cover those rare cases in which the target either holds the memory active indefinitely, or does not access the memory for extended periods.

*Uni*ROM is usually used to emulate the microprocessor's CODE space. All microprocessors regularly access this space to fetch their opcodes and operands. This normal code fetch mechanism provides the basic stimulus *Uni*ROM needs to arbitrate the memory space.

If the target holds /CS AND /OE in-active for extended periods (>2.5 sec.), then one could use ANY of the alternative arbitration methods.. The External Enable method requires one connection to the target, but continues to provide totally un-obtrusive, zero impact arbitration.

If the target holds /CS and /OE active for extended periods of time (> 2.5 sec.), UniROM will be unable to determine when the target is actually accessing the memory or just holding it active, ready for an access. This situation rarely occurs in microprocessor systems. Even minimal embedded controllers will turn off the EPROM between fetches. Some non-micro systems will use EPROMs for lookup tables or other non-code fetch applications (next-state equations, waveform definitions...). Some of these designs may permanently enable the EPROM chip select and output enable. In many of these cases, arbitration may not even be necessary. It may be acceptable for the target system to fetch a garbage byte in the case of a collision. If your system holds the EPROM active for extended periods of time AND arbitration is needed, then External Enable or Request/Grant mode can be used.

The alternative arbitration methods are listed in order, starting with the least intrusive.

Bank Shadowing

*Uni*ROM uses a byte interleaved, dual bank memory architecture. Hardware senses target activity and allows HOST accesses only while the target is accessing the opposite bank. For example, if the HOST wants to access an ODD byte, the hardware will hold off that access until it determines that the target has started an EVEN byte access. At that point, BOTH accesses happen in parallel.

This approach provides completely transparent access to emulation memory without any special restrictions on the target memory access times or cycle times. This method will work in almost all cases and does not require additional connections to the target.

Cycle Interleaving

If the target cycles are much slower than *Uni*ROM's cycle time, Cycle interleaving can be used. This arbitration method allows the HOST to start an access any time the target is not accessing the emulation memory. If a collision occurs, the HOST cycle is completed and then the target cycle is started. This method works if *Uni*ROM access time is at least twice as fast as the target's cycle time.

External Enable

The External Enable input can be used to inform *Uni*ROM when it is safe for it to start an access. This signal could be connected to the /CS of another memory device in the system or to an I/O command line for example. If the target is accessing an I/O device or another memory device, it could not possibly interrupt our access. This signal must remain active (LOW) for at least *Uni*ROM's access time (90,45 or 35ns). This is a very reliable method that requires a single connection to the target.

Ready Arbitration

In Ready Arbitration, *Uni*ROM starts its access when it senses that the target is NOT accessing emulation memory. If the target then attempts to access emulation memory, the READY line is activated to stretch the target's cycle until the HOST cycle has completed. This approach has minimal affect on the target since wait-states are inserted ONLY during collisions.

Request/Grant

In REQUEST/GRANT arbitration, *Uni*ROM asserts REQUEST when it wants to start a cycle and then waits for a GRANT from the target before proceeding. These lines could be connected to the target's BUS REQUEST/GRANT lines or DMA REQUEST/GRANT lines or any similar pair of signals. *Uni*ROM will not actually MASTER the target bus. However, we will be sure of not being interrupted if the target grants us full access.

Chapter 6: VCOM

A VCOM port allows one to eliminate the need for a dedicated target Serial port for debugging. The debug kernel's low level I/O commands are modified to communicate through *Uni*ROM's memory-mapped VCOM. This setup requires that the target has the ability to WRITE to its code space.

VCOM is a VIRTUAL UART. By that, we mean that it looks like a memory-mapped UART to the target, but is actually dual-ported memory that is managed by *Uni*ROM's CPU. Target applications, debug kernels or monitor programs can easily use VCOM in place of a standard hardware serial port, allowing HOST <-> target communications without dedicating any target hardware. Configuration parameters in the Setup/Virtual UARTs menu allows one to specify any address within emulation memory as the BASE address for VCOM. VCOM (if used) occupies 4 bytes of memory, starting at the BASE address as follows (from the target's view):

Register Definitions

Base:	TXBUFF	Transmit Buffer
Base+1:	TXFLAG	Transmit Buffer Full Flag
Base+2:	RXFLAG	Receive Buffer Full Flag
Base+3:	RXBUFF	Receive Buffer

Example Code

The following code fragments demonstrate how the target interfaces with VCOM:

```
send_character(data)
  while(TXFLAG not equal to 0)          // wait here until TX buffer is empty
        continue;
                                        // now send the data and set the FULL flag
  TXBUFF = data;                        //    fill the TX buffer
  TXFLAG = 1;                           //    indicate tx buffer full


get_character()
  while(RXFLAG equal to 0)              // wait here until the RX buffer is FULL
    continue;
                                        // now get the character and clear the FULL flag
  c = RXDATA;                           //   get the data byte
  RXFLAG = 0;                           //   indicate rx buffer empty
  return(c);                            // return data to the caller
```

Notice the similarity between VCOM and a standard UART. The main difference is that with VCOM, the target must perform the additional step of clearing or setting the FULL flags.

If VCOM interrupts are enabled in the setup menu, then *Uni*ROM will generate an interrupt whenever it places data in the TXBUFFER or removes data from the RXBUFFER.

Chapter 7: Advanced Applications

EPROM Emulation

First of all, *Uni*ROM is an intelligent, high speed MEMORY EMULATOR with both Serial and Parallel HOST interfaces. By eliminating the time and hassle of removing-erasing-programming and re-installing EPROMS, *Uni*ROM allows one to upload and test new code revisions in seconds. This quick turn-around makes it feasible to debug firmware by commenting out suspect code, adding print statements, toggling control pins, flashing LEDs, etc.

Advanced Memory Emulation

*Uni*ROM provides target write-back capability. This feature allows for "bread-crumbing"; a technique in which the target writes trace/debug information into memory for post-mortem analysis by the HOST. The write-back feature also allows debug Kernels, Monitors or an ICE to write break-points or to download code into emulation memory from the target side. This often eliminates the need for overlay-memory or extra SRAM for debugging and permits "in-place" debugging.

*Uni*ROM has a separate power supply, allowing it to operate completely independently of the target. To insure safe operation, *Uni*ROM monitors the target's power. *Uni*ROM tri-states all target signals and write protects emulation memory when target power drops below 4.1 Volts. This allows one to power the target up and down during development, without damaging the target or *Uni*ROM.

Dual-port Memory Architecture

One of *Uni*ROM's most advanced features is its dual-ported memory architecture. This allows *Uni*ROM full access to the emulation memory while the target is executing out of the same memory. *Uni*ROM achieves this without inserting wait-states, generating bus-requests or impacting the target in any way.

Real-time memory access enables "Dynamic bread-crumbing", where the HOST can read the trace/debug information while the target is executing, rather than post-mortem. More importantly, it allows the HOST to modify emulation memory in real-time. This capability can be used to pass messages/commands between the target and HOST through shared memory. It also allows one to modify loop variables, delay constants, look-up tables, bit-maps, communications buffers, BUFFER-FULL flags, etc. On-the-fly, dual-ported reads and writes to the emulation memory enables shared memory communications and real-time target control and status.

Real-time Watches

*Uni*ROM exploits its dual-port capability to provide real-time watches. Up to 8 different, variable length watch locations can be specified by the user. When enabled, these locations are constantly read and displayed on the HOST's screen, allowing a real-time, polled view of the data at those locations. Note that this memory watching does NOT affect the target in any way. This capability can be used to monitor task IDs, ring-buffer pointers, FIFO pointers, Communications buffers, Dynamic bread-crumbs or anything else of interest within the emulation memory.

Memory-Mapped Communications

*Uni*ROM manages shared memory communications between the HOST serial port and the target with CONSOLE PATHS and memory-mapped communications ports (VCOM and URCOM). This feature adds a new communications path for the target without modifying the target.

Target monitor programs can use this feature to communicate with a terminal emulator or URTERM. Software debuggers can communicate with their remote kernels. Programmers can use this feature to send important data to a terminal emulator or other program to aid in debugging the firmware.

Some customers insert "bread crumb messages" throughput their PRODUCTION code. If a firmware issue comes up in the field, they can simply plug in a *Uni*ROM, run a script file and watch the messages. This has the advantage that the message watching does not change the firmware execution paths or timing since it has been "sending" these messages all along. Others have written their own PC based front-ends that will capture those messages for later analysis.

The HOST can "ESCAPE" from a CONSOLE connection back to command mode at any time by pausing for at least 2 seconds and then sending three + characters. Typically, one would escape to command mode to perform high speed uploads, modify memory, watch some variables, change a control line, view a status line or reset the target. Selecting "CONSOLE" from the main menu returns the Serial Port to console mode where we resume communications with the kernel, monitor or the target application itself.

Debugger Support

We designed *Uni*ROM from the ground-up to support debugging. The previous sections discussed *Uni*ROM's powerful stand-alone capabilities. The following sections describe the advanced features that allow *Uni*ROM to enhance software debuggers and monitors, giving them ICE-like capabilities.

Debug monitors are an extremely cost-effective means of debugging an embedded system. They are often provided free by the CPU manufacture or are available from Engineering related BBSs as Shareware or even Public Domain. Monitors run entirely in the target's code space and communicate with a terminal emulator through a serial link.

Remote style Software Debuggers provide source-level debugging at a very reasonable price. Software debuggers place a small kernel in the target's code space. This kernel consists of the bare minimum code necessary to communicate with the HOST and to read/write memory, I/O and registers. The bulk of the debugging code executes on the HOST.

However, monitors and software debuggers have limitations which limit or preclude their use in many systems. *Uni*ROM minimizes those restrictions and adds some ICE-like enhancements.

NOTE that the following feature descriptions are applicable to ANY debugger, running on ANY HOST that uses an RS-232 port to communicate with debug code on ANY TARGET with a memory socket.

Eliminates need for a Serial port on the target

The memory-mapped communications discussed earlier are the first step in enhancing Debuggers. This capability eliminates the need to dedicate (or add) a target serial port and any support hardware or timers to support debugging.

Eliminates the need for extra SRAM for debugging

Normally, a debugger will require that you debug your application in SRAM. This is required because the debugger needs to be able to write to this space to load the application and to write breakpoints into the code. *Uni*ROM accepts target write cycles, making it possible for the debugger to load and patch the application in EPROM space.

Speeds up the Process

A single *Uni*ROM script can load the debugging kernel and the application into EPROM space before starting the debugger. This can be done through the serial port at 115KBaud, regardless of the debuggers maximum baud rate. Alternatively, one could use the Parallel port for 70KBYTE/second transfers if desired. A single script file could do the parallel load, configure and initialize the CONSOLE path on the serial link and then start the debugger.

Since the kernel code is located within *Uni*ROM's emulation space, there is no need to burn EPROMs, even for the kernel. This can speed up the process of bringing up the debugger for the first time as well.

Eliminates the need to dedicate the EPROM to the debugger

Since *Uni*ROM permits the application and the debug kernel to co-exist in the EPROM space, there is no need to dedicate the EPROM to the kernel. *Uni*ROM can emulate the EPROM, eliminating the need to burn EPROMs for anything until the project is ready for production.

Expansion Connectors

*Uni*ROM has internal expansion connectors for add-in hardware options. These connectors allow field upgrades to include a trace-buffer option. These options work in conjunction with UniROM Debugger eXtensions (UDXs) to provide ICE-like trace capabilities to 3rd party software debuggers.

Advanced Debugger Support (UDXs)

The concepts presented in earlier sections apply to ALL targets. The DEBUGGER SUPPORT section is applicable to ANY debugger on ANY HOST that uses an RS-232 interface to communicate with debug code on ANY target that has a memory socket. This means that *Uni*ROM is a very powerful AND general purpose tool; a difficult combination to achieve!

However, we designed another feature into *Uni*ROM that allows it to adapt itself to specific debuggers. This allows us to dynamically customize *Uni*ROM to a specific debugger so that we can take full advantage of *Uni*ROM's advanced features. This feature is called *Uni*ROM Debugger eXtensions (UDX).

A UDX is a custom *Uni*ROM software driver supplied by TechTools or your debugger vendor. UDXs are loaded into *Uni*ROM by a script command, a Library function or from the ASCII interface. UDXs intercept the communications between the HOST and the target kernel. They allow *Uni*ROM to enhance the software debugger with its advanced hardware features, **without HOST-side drivers or other custom software.** We continue to use standard, unmodified, off-the-shelf software debuggers. This is a very unique capability.

Many debuggers have hidden capabilities that are only enabled when they determine that they are communicating with an ICE. UDXs allow *Uni*ROM to respond like an ICE, unlocking those features. They also allow *Uni*ROM to intercept and respond to the extended commands the debugger will generate when it believes it is communicating with an ICE.

Typical ICE mode features are Dynamic mode operation, real-time watches, software breakpoints in EPROM, code patches in EPROM, hardware breakpoints and trace buffer support.

UDXs also allow full debug in EPROM without target write access to the EPROM. This eliminates the possibility that the target may corrupt the application or the kernel with “stray bullets”. It also prevents the debug version from working (and the production version failing) due to some unknown dependency on the fact the firmware is in writable memory (the firmware may be initializing statics in EPROM or using EPROM space for variables). This brings the debug environment as close as possible to production release.

UDXs allow us to make the debugger more robust by minimizing its dependence on the health of the target The UDX itself maintains the communications link with the Debugger. This gives us the ability to continue servicing some commands from the HOST side debugger after the target has died (gone off in the weeds, lost its mind, in never-never land, out to lunch, went stupid, in the ozone..). If the debugger supports a target RESET command, the UDX can actually carry out that command (a dead target could not).

Finally, UDXs allow us to minimize the size of the debug kernel. Since we assume responsibility for maintaining the communications link, we can remove this code from the kernel. In addition, we assume responsibility for executing some of the debugger commands, like loading the application, patching the code, setting software breakpoints and resetting the target. We can remove this code from the kernel as well. In some cases, we completely ELIMINATE the kernel. The UDX swaps very small chunks of code into the target memory space when needed, to carry out the debugger’s command.

Chapter 8: Advanced Scripts

Script files allow full control over all *Uni*ROM functions. The script files defined in previous chapters were intentionally minimized to focus on basic concepts. This chapter explains some of the advanced uses for script files.

Loading/Verifying Multiple Files

Loading and Verifying multiple files is easy. Simply specify several LOAD and/or VERIFY commands in the COMMAND section. Each line is completely stand-alone. Different file formats and load addresses can be specified for each file. For example, suppose you had three different files you needed to load into *Uni*ROM's emulation space as follows:

file 1: kernel.bin - A debug kernel - 8KByte BINARY file located at 0xfE000.
file 2: app.hex - You application code(in HEX) starting at 0xf0000.
file 3: data.bin - A BINARY data table loaded at 0xfc000.

Since these files are created by different methods, there may not be a central mechanism for insuring that they do not "grow" into each other's space. We can check for that with the script file by loading all three files BEFORE verifying any of them. If any of them begins to overlap the others, we will get verify errors.

The following script demonstrates how a single script could be used to handle this configuration. Note that we can hold the target in RESET throughout the command section. This ensure that the target can not corrupt any of the data before our loading and verification is complete. Asserting RESET ensures that the target gets a clean start after ALL files are in place and verified. If any of the files fail verify, the script is terminated and the target is left in RESET.

```
[HOST]
PORT  LPT2

[CFG]
DEVICE 64  F0000  EPROM
RESET  LOW  TRI-STATE

[CMD]
RESET  ON
LOAD  BIN   kernel.bin  fe000
LOAD  HEX  app.hex  f0000
LOAD  BIN   data.bin  fc000
VERIFY  BIN  kernel.bin  fe000
VERIFY  HEX app.hex  f0000
VERIFY  BIN  data.bin  fc000
RESET  OFF
```

Controlling Multiple UniROMs

This topic is covered in Chapter 14, but it is worth touching on here. The *Uni*ROM scripts are designed to handle all issues relating to multiple *Uni*ROMs. Separate CONFIGURATION sections can be defined for each attached *Uni*ROM. Additionally, the COMMAND section has a SELECT command which allows one to specify which *Uni*ROM should receive commands. The SELECT commands are MODAL, meaning that once a particular *Uni*ROM is selected, all commands in the script are sent to that *Uni*ROM until another SELECT command is encountered. Refer to Chapter 14 for additional examples.

Console Path Initialization

*Uni*ROM script files allow one to configure and initiate CONSOLE paths. This permits one to fully automate:

Configuring each *Uni*ROM
Loading debug kernels or monitors
Loading the application code
Configuring and initiating the CONSOLE connection
Waiting for target activity
Starting the Software Debugger

A simple batch file can call URLOAD then start the debugger. This provides a simple method of consistently starting up a debugging session. It also provides a baseline that is easy to return to. One can archive the *Uni*ROM script along with other project files. If additional work is needed on any particular project, one need only to run the script to start debugging again.

A SPECIAL NOTE ABOUT THE CONSOLE COMMAND: The CONSOLE command establishes a connection between *Uni*ROM's SERIAL port and the selected console path (SERIAL OUT, VCOM or URCOM). If you are executing the script on a SERIAL port, you will not be able to send additional commands to *Uni*ROM after the CONSOLE command. In other words, the CONSOLE command must be LAST command in the script if you are configuring *Uni*ROM through the serial port. The console command will automatically release target RESET when it establishes the console path connection, eliminating the need for a RESET OFF command. This is not a bug. If you think about it, the CONSOLE command MEANS "stop interpreting data from the SERIAL PORT as my commands and start sending those characters to the target (via the console path)".

If you are loading files into multiple *Uni*ROMs, you can SELECT each one and perform all necessary commands. When everything is ready, SELECT the *Uni*ROM which will maintain the console connection and issue the CONSOLE command. Refer to Chapter 14 for more information on multiple *Uni*ROM configurations.

If you are configuring and controlling *Uni*ROMs through the parallel port , this restriction does not apply. You can continue selecting *Uni*ROMs and sending commands after issuing the CONSOLE command because you have not broken your command connection. Of course this requires two connections; parallel for the script control and transfers, and serial for the CONSOLE connection.

Waiting for Target Activity

The WAIT command can be very useful. It allows the script file to pause until it sees activity from the target. Some targets are very slow to start or may have very variable startup times. For example, if the target initializes hardware devices (like hard disks), it may take several seconds (or even minutes) to start executing the debug kernel. The WAIT command allows the script to ensure that the target is accessing *Uni*ROM's emulation memory before continuing to start the debugger.

Creating EPROM Images

Once debugging is complete, one needs to create EPROM images. These are used to "burn" EPROMs for production and to archive the released product. In many cases, the files that *Uni*ROM has been loading are already suitable for this purpose and no additional steps are needed.

In some cases additional work needs to be done on the file(s) to create a suitable image. For example, one may have several different files that are combined to create a complete EPROM image. In other cases, the development tools might generate a single file that needs to be spilt or divided among several EPROM images for the target.

*Uni*ROM script files can perform this manipulation. Simply create a script that loads one or more file into emulation memory and then performs one or more SAVE commands to write the desired data ranges out to files.

EXAMPLE 1 - Merging FILES

The "LOADING MULTIPLE FILES" example demonstrates loading several files into memory and then verifying that they loaded correctly and did not corrupt each other. The following script adds two commands (FILL and SAVE) to that example to demonstrate this use of a script.

```
[HOST]
PORT  LPT2

[CFG]
DEVICE 64  F0000  EPROM
RESET  LOW  TRI-STATE

[CMD]
RESET  ON
FILL f0000 fffff ff
LOAD  BIN   db.bin  fe000
LOAD  HEX  app.hex  f0000
LOAD  BIN   data.bin  fc000
VERIFY  BIN  db.bin  fe000
VERIFY  HEX app.hex  f0000
VERIFY  BIN  data.bin  fc000
SAVE  BIN  final.bin f0000 fffff
RESET  OFF
```

The fill command ensures that any unreferenced locations are initialized to a consistent value. A blank EPROM is filled with 0xFF so this is a logical value. Some people prefer to initialize unused locations with a BREAK command (0xCC in the x86) so that run away code will break into a debug routine and get trapped.

Note that this manipulation can be performed without a target. However, it gives one a feeling of closure to watch the target execute the data created by this script, ensuring that the FINAL.BIN was extracted from a configuration known to work. Performing this manipulation with *Uni*ROM, rather than an EPROM programmer or separate utilities eliminates the possibility of introducing errors by adding another step in the process. Of course, if you use other methods to manipulate the data, you can load the resulting files back into *Uni*ROM for final verification before committing to EPROMS.

EXAMPLE 2 - Splitting files

The following script example demonstrates a case where the development tools generate a single file, but the target uses ODD/EVEN interleaved EPROMs. A 16 bit *Uni*ROM accepts the single file during development and automatically splits the file during each load. At the completion of development, we run the following script to produce two separate EPROM images (ODD and EVEN) for production and archiving.

```
[HOST]
PORT  LPT2

[CFG]
ORGANIZATION  EVEN/ODD            // lower board EVEN, upper ODD
DEVICE 64  E0000  EPROM           // Each board emulates a 27512
RESET  LOW  TRI-STATE

[CMD]
RESET ON
TRANSFERS BOTH
FILL E0000 FFFFF FF               // fills 128KBytes
LOAD  HEX  app.hex  E0000
TRANSFERS LOWER
SAVE  BIN  EVEN.BIN E0000 EFFFF   // save 64K of EVEN BYTES
TRANSFERS UPPER
SAVE  BIN   ODD.BIN   E0000 EFFFF // save 64K of ODD BYTES
RESET  OFF
```

Chapter 13 discusses 16 bit issues. Refer to Chapter 9 for a detailed description of these parameters.

Chapter 9: Script Command Reference

Script files contain complete configuration and command information for URLOAD, URTERM and UREDIT. Each script file contains a HOST section, one or more CONFIGURATION sections and a COMMAND section (in that order). Each section is discussed below.

All ADDRESS parameters are specified in HEX without a leading '0X' or trailing 'h'. For example 0xE0000 (in C nomenclature) or 0E0000h (in ASM nomenclature) would be entered as E0000. Also note that all memory parameters use REAL PHYSICAL addresses from the target's perspective. *Uni*ROM software, firmware and hardware determines the exact memory location within *Uni*ROM that corresponds to that physical address, based on the device starting address and memory organization (single, dual, odd/even or even/odd interleaved) settings.

Also note that all reads, writes, loads, verifies and saves act on *Uni*ROM emulation memory. One can not use a LOAD script command to load data into a target memory space which is not being emulated by *Uni*ROM. We use real physical addresses in all parameters to provide a consistent real-world baseline. However, one should not infer that *Uni*ROM can "reach outside" of its memory space and access other memory spaces. For example, if *Uni*ROM is emulating an EPROM that covers 0xE0000 to 0xFFFFF in the target address space, we could not access data below 0xE0000 or above 0xFFFFF with script commands. Reaching other memory spaces, I/O spaces or CPU registers requires a CPU specific MONITOR program, Software Debugger Kernel or other application code executing on the target. *Uni*ROM can integrate into these types of products.

HOST Section

This MUST be the first section in the script file. All lines before the PORT command will be ignored.

PORT [address] [baud] [interrupt]

Specifies which HOST port to use for *Uni*ROM communications. This line is MANDATORY.

address:

Specifies which PORT should be used for *Uni*ROM communications. One can specify a standard LOGICAL DEVICE NAME (LPT1, LPT2, LPT3, COM1, COM2, COM3, COM4) or an absolute address. Absolute addresses are specified as Sxxx or Pxxx, where 'S' implies a serial port and 'P' implies a parallel port. The 'xxx' is an absolute I/O address in HEX. For example, P378 is a printer port at 0x378.

baud:

Specifies the BAUD-RATE for SERIAL port communications.
VALID values: 1200,2400,4800,9600,19200,38400,57600,115200

interrupt:

Specifies the INTERRUPT number for SERIAL ports. This parameter is normally not used if the SERIAL port was specified with a COMx type address. *Uni*ROM uses the standard IRQs associated with COM1-4. This parameter over-rides those assumptions. If the SERIAL address was specified with the Sxxx format, *Uni*ROM will REQUIRE this parameter. Be careful with this parameter. Specifying an IRQ that is already in use may cause system instabilities or a "lock-up".
VALID settings: 2,3,4,5,6,7,8,9,10,11,12,13,14,15

Configuration Section

The configuration section holds configuration information for *Uni*ROM. The information in this section is loaded into *Uni*ROM before the command section is executed. This introduces negligible overhead and establishes a consistent, repeatable, reliable startup.

Multiple configuration sections can be defined, one for each *Uni*ROM attached to this port.

ORGANIZATION [mem_org]

Specifies how the target views *Uni*ROM's memory boards. The target may view *Uni*ROM as a single 8 bit device, two independent 8 bit devices, or two interleaved devices in ODD/EVEN or EVEN/ODD configurations. This option only applies to 16 bit *Uni*ROMs.

mem_org:

Valid settings: Single, Dual, Even/odd or Odd/even

DEVICE [size] [address] [type]

Specifies what size and type of memory device *Uni*ROM should emulate. Also specifies its starting address in the target's memory space.

size:

Specifies the device size in decimal KBytes. For example, if one is emulating a 27020 EPROM, this parameter would be set to 256 (the 27020 is a 256 KByte device).

address:

Specifies the starting address of the memory device in the target's memory space in HEX. This parameter is used to validate all commands that access memory. It is also used to calculate the exact memory location with *Uni*ROM that corresponds to a given memory access request. If your target EPROM starts at 0xe0000, you would enter E0000 for this parameter.

type:

Specifies the type of device *Uni*ROM should emulate. Valid options are EPROM and FLASH.

WARNING: *Uni*ROM can be configured to pin-out for FLASH devices. HOWEVER, it is a 5 Volt ONLY device. DO NOT APPLY PROGRAMMING VOLTAGES TO *Uni*ROM. It WILL RESULT IN PERMANENT DAMAGE TO UNIROM.

ARBITRATION [type] [timeout] [action]

Specifies the parameters for ARBITRATED accesses to emulation memory. These parameters have NO affect while the target is turned OFF or *Uni*ROM has asserted RESET. In these situations, *Uni*ROM overrides these parameters and forces arbitration in its favor. Most script files will hold RESET active through-out the script, eliminating the need to include this configuration.

type

Specifies the arbitration method *Uni*ROM should use for memory accesses while the target is running. The default method is Bank Shadowing. Valid options are:

B: Bank-Shadowing
C: Cycle-Interleaving or Ready
G: Grant or External CS
N: None

A complete description of each option is located in Chapter 5.

timeout

Specifies how long (in milliseconds) *Uni*ROM should wait on an arbitrated memory access to complete.

action

Specifies how *Uni*ROM should react if the hardware reports an arbitration timeout. Valid options are RESET and ERROR. If RESET is selected, *Uni*ROM will react by asserting reset to the target and completing the memory access. If ERROR is selected, *Uni*ROM will abort the access and report an ARBITRATION TIMEOUT error. The default is action is RESET.

NOISE-FILTER [flag]

flag:

Turns ON or OFF the digital noise filter on target control and address signals. When turned ON, these signals are filtered. This increases *Uni*ROM's immunity to ground-bounce, signal reflections etc. When turned OFF, *Uni*ROM's access times are reduced by 10ns. The default setting is ON. This option is always left ON for normal operation. It is included to allow maximum flexibility. If you are "pushing" *Uni*ROM to emulate devices faster than its ratings, you might try turning the filter OFF to speed up *Uni*ROM.

UPPER DEVICE [size] [address] [type]

This item sets the DEVICE parameters for the UPPER memory board in a 16 bit *Uni*ROM. Its parameters are identical to DEVICE.

size:

Specifies the device size in decimal KBytes. For example, if one is emulating a 27020 EPROM, this parameter would be set to 256.

address:

Specifies the starting address of the memory device in the target's memory space in HEX. This parameter is used to validate all commands that access memory. It is also used to calculate the exact memory location with *Uni*ROM that corresponds to a given memory access request. If your target EPROM starts at 0xe0000, you would enter E0000 for this parameter.

type:

Specifies the type of device *Uni*ROM should emulate. Valid options are EPROM and FLASH.

WARNING: *Uni*ROM can be configured to pin-out for FLASH devices. HOWEVER, it is a 5 Volt ONLY device. DO NOT APPLY PROGRAMMING VOLTAGES TO *Uni*ROM. It WILL RESULT IN PERMANENT DAMAGE TO UNIROM.

UPPER ARBITRATION [type] [timeout] [action]

This item sets the arbitration parameters for the UPPER emulation board in a 16 bit *Uni*ROM. Its parameters are identical to ARBITRATION.

type

Specifies the arbitration method *Uni*ROM should use for memory accesses while the target is running. The default method is Bank Shadowing. Valid options are:

B: Bank-Shadowing
C: Cycle-Interleaving or Ready
G: Grant or External CS
N: None

A complete description of each option is located in Chapter 5.

timeout

Specifies how long (in milliseconds) *Uni*ROM should wait on an arbitrated memory access to complete.

action

Specifies how *Uni*ROM should react if the hardware reports an arbitration timeout. Valid options are RESET and ERROR. If RESET is selected, *Uni*ROM will react by asserting reset to the target and completing the memory access. If ERROR is selected, *Uni*ROM will abort the access and report an ARBITRATION TIMEOUT error. The default is RESET.

UPPER NOISE-FILTER [flag]

Enables the NOISE filter on the UPPER emulation board in a 16 bit *Uni*ROM. Its parameters and function are identical to NOISE FILTER

flag:

Turns ON or OFF the digital noise filter on target control and address signals. When turned ON, these signals are filtered. This increases *Uni*ROM's immunity to ground-bounce, signal reflections etc. When turned OFF, *Uni*ROM's access times are reduced by 10ns. The default setting is ON. This option is always left ON for normal operation. It is included to allow maximum flexibility. If you are "pushing" *Uni*ROM to emulate devices faster than its ratings, you might try turning the filter OFF to speed up *Uni*ROM.

RESET [active level] [driver]

active level

Specifies which logic level actives RESET on the target (at the point you have connected the reset line). *Uni*ROM will assert this level anytime it wants to reset the target. Valid settings are HI or LOW.

driver type

Specifies the type of driver *Uni*ROM should use to drive the reset line.

Valid settings: TRI-STATE and BI-POLAR.

INTERRUPT [active level] [driver]

active level

Specifies which logic level actives an INTERRUPT on the target (at the point you have connected the interrupt line). *Uni*ROM will assert this level anytime it wants to interrupt the target.

Valid settings: HI or LOW.

driver type

Specifies the type of driver *Uni*ROM should use to drive the reset line.

Valid settings: TRI-STATE and BI-POLAR.

Command Section

This section consists of a series of commands. These commands are executed in order, giving one full control over the sequence of events.

SELECT [unirom ID]

Used to SELECT one of several *Uni*ROMs on a DAISY-CHAIN or MULTI-DROP configuration. The SELECTED *Uni*ROM will receive all commands until another select command is encountered. If only ONE *Uni*ROM is attached, this command is not necessary.

unirom ID

The ID of the *Uni*ROM we wish to talk to. DO NOT USE an ID of 0 unless only one *Uni*ROM is attached. 0 is a special "ALL CALL" ID which ANY (and ALL) *Uni*ROM(s) will respond to. If using multiple *Uni*ROMs, this parameter is required. If you are using a single *Uni*ROM, this command is not necessary but you could use its actual ID here or '0'.

TRANSFERS [mode]

Specifies a specific emulation board within a 16 bit *Uni*ROM. All script command memory accesses will act on the specified emulation board(s) until another TRANSFERS command is encountered. Refer to Chapter 13 for additional information on the use of this command.

mode

Valid options for 16 bit *Uni*ROMs are: LOWER, UPPER or BOTH.
This command is not needed for 8 bit *Uni*ROMs, but *Uni*ROM will accept TRANSFERS LOWER without errors.

RESET [flag]

Turns ON, OFF or PULSES the RESET line.

flag

Sets, clears or pulses the RESET line. Note that doing a "RESET ON" ACTIVATES the reset line, meaning that it drives it to the logic level defined in the configuration section for reset active. This could a high or a low logic level. Valid settings are ON, OFF or PULSE.

A SPECIAL NOTE: When one issues a RESET ON command, *Uni*ROM over-rides any arbitration settings and forces access to emulation memory, regardless of the target's current state. In addition, *Uni*ROM selects optimized routines for all memory accesses that bypass the arbitration hardware. This provides the fastest possible accesses.

We recommend starting the script command section with a RESET ON command unless you truly need to do arbitrated memory accesses. Of course you should add a RESET OFF command at the end of the script to let the target run and restore the arbitration settings.

Even if you turn target power off or have no target attached, we recommend a using a "RESET ON" command. Even though we will always win arbitration with or without the RESET command, we will perform faster transfers with RESET ON.

INTERRUPT [flag]

Turns ON, OFF or PULSES the interrupt line.

flag

Sets, clears or pulses the INTERRUPT line. Note that doing a "INTERRUPT ON" ACTIVATES the interrupt line, meaning that it drives it to the logic level defined in the configuration section for interrupt active. This could a high or a low logic level. Valid settings are ON, OFF or PULSE.

LOAD [file type] [name] [address]

Loads the specified file into *Uni*ROM's emulation memory.

file type

Specifies the type of file we are transferring to *Uni*ROM. Valid options are BIN or HEX. Use BIN if the file is a raw binary image of the data. Use HEX if the file is in a formatted HEX format. *Uni*ROM accepts all Intel HEX, Motorola 'S', Tektronix and Extended Tektronix formats.

name

Specifies the name of the file you wish to transfer. This parameter accepts any valid DOS filename including full drive and path information.

address

Specifies the load address for this file. If loading a BINARY file, this specifies the exact target address to start loading the file. For HEX files, this is used as a default address that is used ONLY if the HEX file itself does not specify an address. Most HEX files have full address information embedded within them, which will over-ride this setting.

VERIFY [file type] [name] [address]

Performs a verify of the specified file against data already in *Uni*ROM's emulation memory.

file type

Specifies the type of file we are verifying. Valid options are BIN or HEX. Use BIN if the file is a raw binary image of the data. Use HEX if the file is in a formatted HEX format. *Uni*ROM accepts all Intel HEX, Motorola 'S', Tektronix and Extended Tektronix formats.

name

Specifies the name of the file you wish to verify. This parameter accepts any valid DOS filename including full drive and path information.

address

Specifies the target address (in HEX) of the data you wish to compare to this file. If verifying a BINARY file, this specifies the exact target address to verify against. For HEX files, this is used as a default address that is used ONLY if the HEX file itself does not specify an address. Most HEX files have full address information embedded within them, which will over-ride this setting.

SAVE [file type] [file name] [start address] [end address]

Saves a block of *Uni*ROM's emulation memory to a file.

file type

Specifies the data format in which to save the file. Currently the only valid type is BIN.

file name

Specifies the name of the save file. This parameter accepts any valid DOS filename including drive and path information.

start address

Specifies the starting target address (in HEX) of the data block.

end address

Specifies the last target address (in HEX) of the data block.

FILL [start address] [end address] [value]

Fills a block of *Uni*ROM's emulation memory with a single value.

start address

Specifies the first target memory address (in HEX) to fill.

end address

Specifies the last target memory address (in HEX) to fill.

value

Specifies the data (in HEX) to use during the fill.

CONSOLE [path] [address] [IRQ mode] [baud]

Configures and initiates a CONSOLE connection.

path

Specifies the destination port.

Valid settings: URCOM, VCOM, SERIAL-OUT

address

Specifies the base target memory address (in HEX) of VCOM or URCOM port connections. Specify 0 for SERIAL OUT connections.

IRQ mode

Specifies when *Uni*ROM should activate the INTERRUPT line. If RX is selected, *Uni*ROM will generate an interrupt anytime it sends a character to URCOM or VCOM. If TX is selected, *Uni*ROM will generate an interrupt anytime it receives a character from URCOM or VCOM. If BOTH is selected, *Uni*ROM will generate an interrupt in either situation. Of course if NONE is selected, *Uni*ROM will NOT generate interrupts. Valid settings are: RX, TX, BOTH or NONE

baud

Specifies the BAUD-RATE used for the CONSOLE connection.
NOTE: This can be different than your current BAUD-RATE. This feature allows for high bandwidth loads and verifies while maintaining the ability to CONSOLE to debuggers which run at slower rates.

If the PORT line at the top of the current script specified a SERIAL port, the CONSOLE command must be the last command in the script. The CONSOLE command will re-direct all serial port activity to the CONSOLE path instead of the BINARY PACKET interpreter.

Valid values: 1200, 2400,4800,9600, 19200, 38400, 57600, 115200

ECHO [message]

Prints the specified message to the PC screen.

message

Specifies the text to print.

PAUSE [millisecs]

Causes the script to pause for the specified length of time. If the parameter is omitted, the script will pause until the user presses a key.

millisecs

The number of milliseconds to pause.

OUT [control_ID] [value]

Sets or clears an individual control line.

control ID

Specifies which line to change (1-4)

value

Specifies the new level for this control line.

Valid settings are LOW or HIGH.

WAIT

Pauses the script until target activity is detected or the user presses a key; whichever occurs first. This command repeatedly calls GET STATUS until the TARGET ACTIVE bit indicates that a target access cycle was detected. NOTE that this is NOT guaranteed to detect the first target cycle. It is simply polls the current status until a target access is captured. If the target is active, this will occur within a few polls.

GET STATUS

Gets and displays the current status byte from *Uni*ROM. This byte is encoded as follows:

bit 7: Target Activity Detected
bit 6: Target POWER ON
bit 5: RESET Active
bit 4: -
bit 3: STATUS line 4
bit 2: STATUS line 3
bit 1: STATUS line 2
bit 0: STATUS line 1

These items are NOT latched. The status returned is the actual status at the instant it is read. In particular, the TARGET ACTIVE flag is set if a target access to *Uni*ROM's memory is occurring at that exact instant.

Chapter 10: URTERM

URTerm is a terminal emulator that can communicate with *Uni*ROM through Serial OR Parallel ports. It simply relays characters between the HOST PC and *Uni*ROM, allowing one to interact with *Uni*ROM's built-in ASCII interface. In this manner, URTERM provides the EXACT same interface one would see through a terminal emulator on ANY HOST. A notable difference between URTERM and a conventional terminal emulator is the fact that URTERM can communicate through a Parallel port connection for ultra *FAST* communications and uploads.

URTERM gets its configuration information from a script file. It only reads the HOST data from the file. The CONFIGURATION and COMMAND sections are ignored. This allows one to create a single script file for a given project that is used by both URLOAD and URTERM.

URTERM is provided to allow access to *Uni*ROM's ASCII interface for real-time access to *Uni*ROM's memory. It will be replaced with a full-screen editor in the near future.

URTERM SETUP

There are no special setup considerations for URTERM. Any script that works with URLOAD can be used with URTERM. If no script file name is given, URTERM will look for "UNIROM.CFG" in the current directory.

If you followed through the startup in Chapter 1, you should have a working script file called "test.cfg". Start URTERM, using the PORT information from this file as follows:

```
URTERM   TEST.CFG
```

You should see a sign-on message from URTERM and then the MAIN MENU from *Uni*ROM. If you receive any error messages, verify that the PORT definition in the TEST.CFG file is still valid for you current configuration. If this look s correct, return to Chapter 1 and re-establish a working baseline.

If the sign-on message appears but the menu does not, do the following:

1. Exit URTERM by pressing ALT-Q, F3 or ALT-X.
2. Turn *Uni*ROM's power switch off for 5 seconds and then back on.
3. Restart URTERM with "URTERM TEST.CFG".

We do not expect that you will ever encounter this situation, but this would be the correct procedure to insure a proper recovery. We built safety timers into all *Uni*ROM operations to insure that it does not hang on any event. URTERM should always be able to get *Uni*ROM's attention. The only known exception is if you start a memory test, exit URTERM, and then try to restart URTERM before the memory test is complete. In this scenario, *Uni*ROM may not respond until the test is completed.

UniROM Setup

URTERM does NOT use the script file configuration information file to configure *Uni*ROM each time it loads. Instead, it uses *Uni*ROM's current settings. This is intentional. We expect that one would normally use URLOAD for most of their work. URTERM would be used to do memory watching or

patches. Since we do not slam the configuration when we load URTERM, we do not disturb the target's operation. This allows one to start URTERM while the target is executing and snoop memory, etc.

If you run URTERM before running any URLOAD scripts, *Uni*ROM will be configured to the default values stored in EEPROM. If you would like for these values to match any specific script configuration values, do the following:

1. Run URLOAD with the script file containing the desired configurations.
2. Run URTERM
3. From within URTERM, go to the SETUP MENU and select Store Configuration in EEPROM.

These values become the defaults that are used on each power-up until they are changed. Alternatively, one could set the desired configuration from the various SETUP menus and then update the EEPROM with the store command.

*Uni*ROM has many configuration items. All have logical defaults, making it a little easier to manage. However, some items are very specific to your target configuration and will most likely need to be changed. In particular, you will need to review the following items:

Memory Organization (on 16 bit *Uni*ROMs)
DEVICE size, type and address
TRANSFER file type and load address
RESET active level and driver type

We recommend leaving the following items set to their defaults:

AUTO RESET during transfers	= ON
Arbitration METHOD	= BANK SHADOWING
Arbitration Timeout RESPONSE	= RESET
NOISE FILTER	= ON

Refer to Chapter 12 for detailed information on the ASCII interface menus and settings.

File Transfers

When using the ASCII interface to load or verify files, it is important to understand that *Uni*ROM is presenting all of the menus and interpreting all of your keystrokes. The file transfer procedures are very analogous to sending files to a BBS through a terminal emulation program like PROCOMM, WINTERM, QMODEM, White Knight, MacTERM, etc.

File transfers involve TWO computers; the PC and *Uni*ROM. Both need to be told to start an upload or verify. To load a file into *Uni*ROM's memory through the ASCII interface, follow these steps:

1. Go to the TRANSFERS MENU
2. Select LOAD to tell *Uni*ROM to prepare to receive a file.
   (*Uni*ROM will respond with a "Start your UPLOAD" message)
3. Press the PAGEUP key to tell URTERM to send a file.
4. Type a filename or press ENTER to accept the offered default.

Follow this same procedure to VERIFY a file. The ASCII interface verifies a file by having the HOST re-send the file. *Uni*ROM then checks this file against the current contents of its emulation memory. This approach places the verify burden on *Uni*ROM instead of the HOST, making it possible to use simple terminal emulators on the HOST.

Chapter 11: NON-PC Support

*Uni*ROM has an ASCII MENU/COMMAND based protocol built-in, allowing it to operate with any HOST through a serial port and a terminal emulation program (communications program). On board intelligence allows *Uni*ROM to operate with any serial based HOST, WITHOUT CUSTOM HOST BASED SOFTWARE. Refer to Chapter 12 for complete details on the ASCII interface menus and options.

Terminal Emulator Configuration

Configure your terminal emulation program as follows:

1. DIRECT Connection (if your terminal emulator supports it)
2. 115KBaud, No parity, 1 or 2 STOP bits (or the faster rate supported)
3. IGNORE Carrier Detect (CD) and RING Detect (RI).
4. RTS/CTS Hardware Handshaking.
5. FIXED BAUD RATE or NO Auto-BAUD detection.
6. Full DUPLEX (NO LOCAL ECHO)
7. NO CR/LF translation (or any other translations)
8. RAW ASCII file transfers without any translations, PACING delays or PACING Characters.
9. No MODEM INITIALIZATION codes

Uni*ROM Setup*

Start your terminal emulator. If your terminal emulator supports it, send a BREAK for at least 10 milliseconds to get *Uni*ROM's attention. This is not essential, but it does provide a consistent starting point, eliminating any concerns about *Uni*ROM's current operating mode. Press the ENTER key (carriage return) several times until *Uni*ROM presents you with the MAIN MENU. *Uni*ROM does a baud-detect on this character. It could take up to 4 key presses for *Uni*ROM to respond. If *Uni*ROM does not respond, it may be in a CONSOLE mode. Try pausing for at least 2 seconds, and then pressing the '+' key three times. Now press the enter key until *Uni*ROM responds. If this fails to get *Uni*ROM's attention, cycle power on *Uni*ROM and verify your terminal emulator configuration.

Once *Uni*ROM responds with its main menu, go to the SETUP menu and configure the items listed below. *Uni*ROM has many configuration items. All have logical defaults, making it a little easier to manage. However, some items are very specific to your target configuration and will most likely need to be changed. In particular, you will need to review the following items:

Memory Organization (on 16 bit *Uni*ROMs)
DEVICE size, type and address
TRANSFER file type and load address
RESET active level and driver type

We recommend leaving the following items set to their defaults:

AUTO RESET during transfers	= ON
Arbitration METHOD	= BANK SHADOWING
Arbitration Timeout RESPONSE	= RESET
NOISE FILTER	= ON
CONSOLE PATH	= NONE

Once these parameters have been set, select STORE from the Setup menu to save the new configuration in EEPROM. These values become the defaults that are used on each power-up until they are changed.

Refer to Chapter 12 for detailed information on the ASCII interface menus and settings.

File Transfers

When using the ASCII interface to load or verify files, it is important to understand that *Uni*ROM is presenting all of the menus and interpreting all of your keystrokes. The file transfer procedures are very analogous to sending files to a BBS through a terminal emulation program like PROCOMM, WINTERM, QMODEM, White Knight, MacTERM, etc.

File transfers involve TWO computers; the HOST and *Uni*ROM. Both need to be told to start an upload or verify. To load a file into *Uni*ROM's memory through the ASCII interface, follow these steps:

1. Go to the TRANSFERS MENU
2. Select LOAD to tell *Uni*ROM to prepare to receive a file.
   (*Uni*ROM will respond with a "Start your UPLOAD" message)
3. Initiate a file upload by whatever procedure your terminal emulator requires.

Follow this same procedure to VERIFY a file. The ASCII interface verifies a file by having the HOST re-send the file. *Uni*ROM then checks this file against the current contents of its emulation memory. This approach places the verify burden on *Uni*ROM instead of the HOST, making it possible to use simple terminal emulators on the HOST.

Chapter 12: ASCII Menu Reference

The following sections document *Uni*ROM's ASCII menu structure and the function of each option. Figure 9 shows a graphical representation of *Uni*ROM's ASCII menu organization. Following the diagram is a description of each menu selection. A detailed ASCII Menu Tree is shown in Appendix E.

The ASCII mode interface allows NON-PC users to access all of *Uni*ROMs feature without dedicated HOST software. Any HOST with an RS-232 serial port and a terminal emulation program can use *Uni*ROM's ASCII interface.

ASCII Menu Tree Structure

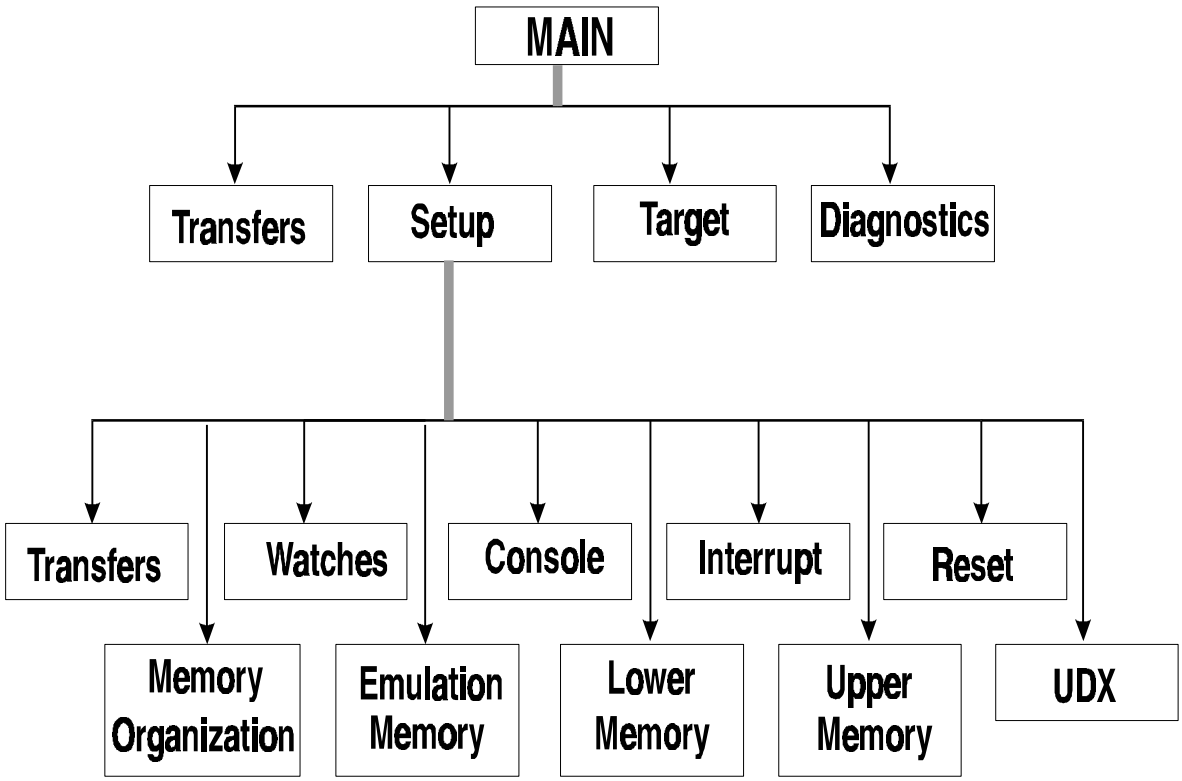


Figure 9 - ASCII Menu Tree Structure

Main

Main is the top-level menu. *Uni*ROM always defaults to the main menu in command mode after a power-up or reset.

Transfers

Displays the TRANSFER menu

Console

Places the SERIAL port in CONSOLE mode if a valid CONSOLE path has been previously configured.

If you are connected to the SERIAL port at the time this is selected, you will be connected to the CONSOLE path. Your keystrokes will be sent to the target through the CONSOLE connection. Any characters from the target will be displayed on your terminal. You can return to COMMAND mode by pausing at least 2 seconds, and then type three consecutive '+' characters.

If you are connected to the parallel port at the time this is selected (through URTERM), you will remain in command mode. The serial port will be connected to the console.

Setup

Displays the top level SETUP menu

Target

Displays the TARGET menu.

Diagnostics

Displays the DIAGNOSTICS menu.

Information

Displays *Uni*ROM's firmware version and hardware ID.

Transfers

The Transfers menu holds all commands related to transferring data to and from emulation memory.

Load

Initiates a transfer of data FROM the HOST, to the target emulation memory. If AUTO-RESET is ON, the target RESET line is activated and the current Arbitration Method is over-ridden, insuring a good transfer, regardless of the target's state. If AUTO-RESET is OFF, the current Arbitration Method is used during the transfer.

Verify

When this option is selected, the user is prompted to re-send the data file. *Uni*ROM compares the current contents of emulation memory against the data sent by the HOST and reports the results. If AUTO-RESET is ON, the target RESET line is activated and the current Arbitration Method is over-ridden, insuring a good transfer, regardless of the target's state. If AUTO-RESET is OFF, the current Arbitration Method is used during the transfer.

Read

Reads and displays the specified number of lines of data from the emulation memory. If no starting address is specified, *Uni*ROM starts at 1 byte beyond the last byte read. The current Arbitration Method is used during the transfer.

Write

Writes the specified data at the specified address within the emulation memory. The current Arbitration method is used during the writes.

Fill

Fills the emulation memory with the specified data byte. If NO data is specified, a unique data pattern is used. If AUTO-RESET is ON, the target RESET line is activated and the current Arbitration Method is over-ridden, insuring a good transfer, regardless of the target's state. If AUTO-RESET is OFF, the current Arbitration Method is used during the transfer.

Select Emulator Board (16 bit *Uni*ROM only)

This option allows one to select the UPPER, LOWER or BOTH emulation boards for READs, WRITEs, FILLs and UPLOADS. NOTE: This option will NOT appear if the "Memory Organization" is set to "Single 8 BIT".

Main

Returns to the main menu.

Setup

The Setup Menu provides access to all configurable items.

Organization

Displays the SETUP Memory Organization menu. This option will not appear on 8 bit *Uni*ROMs

Emulation Memory

Displays the SETUP Emulation Memory menu. This option appears on 8 bit *Uni*ROMs or 16 bit *Uni*ROMs in SINGLE or INTERLEAVED modes.

Lower emulation Memory

Displays the SETUP Lower Emulation menu. This option only appears on 16 bit *Uni*ROMs in DUAL organizations.

Upper emulation Memory

Displays the SETUP Upper Emulation menu. This option only appears on 16 bit *Uni*ROMs in DUAL organizations.

Reset

Displays the SETUP RESET menu.

Interrupt

Displays the SETUP INTERRUPT menu.

Watches

Displays the SETUP WATCHES menu.

Transfers

Displays the SETUP TRANSFERS menu.

Consoles

Displays the SETUP CONSOLES menu.

UDXs

Displays the SETUP UDXs menu.

*Uni*ROM Address

Sets *Uni*ROM's address (ID). This allows one to SELECT individual *Uni*ROMs by their ID. If this is the ONLY *Uni*ROM on this port, this should be set to 1, the factory default.

Use Factory defaults

Uses the factory defaults (from ROM) for all configuration items.

Get configuration from EEPROM

Updates the current configuration with the values stored in EEPROM.

Store configuration in EEPROM

Stores the current configuration in EEPROM. These values will be used as defaults on each power-up until changed.

Main menu

Return to Main menu.

Target

Reset

Pulses the RESET line ACTIVE for 1/2 second and then returns it to the IN-ACTIVE state.

Reset ON/OFF

Holds the RESET line ACTIVE (ON) or IN-ACTIVE (OFF) until another RESET command is issued.

Interrupt

Pulses the INTERRUPT line ACTIVE for approximately 1 microsecond and then returns it to the IN-ACTIVE state.

Interrupt ON/OFF

Holds the INTERRUPT line ACTIVE (ON) or IN-ACTIVE (OFF) until another INTERRUPT command is issued.

View status

Displays the current levels on the user status lines and the current state of target power.

Set control ON/OFF

Sets or Clears the indicated user control line.

Watch

Starts the real-time watch of all enabled Watch-points. Pressing any key will stop the watch and return to this menu.

Main menu

Returns to the Main Menu.

Diagnostics

Single Memory Test

This selection tests the emulation memory. NO arbitration is used. In 16 bit *Uni*ROMs, the lower memory board is completely tested and then the upper board is tested. The following tests are performed:

Stuck Data

Verifies that each data line toggles.

Address Size

Determines how much memory is present by looking for addressing mirrors at each 2^N boundary. *Uni*ROM reports the amount of memory found, but has no way of knowing how much memory it should expect. LOOK CAREFULLY at the amount of memory found to verify that it is correct. A stuck address line or faulty SRAM will result in UniROM finding less memory than is installed.

Memory Test #1

This writes a unique pattern that is guaranteed NOT to repeat on a 2^N boundary. This pattern rotates 1 position on each pass through the test. After ALL memory is filled, each byte is verified.

Memory Test #2

The inverse of the previous pattern is used to test the memory again. This insures that every bit can toggle.

Continuous Memory Tests

Repeats the Single Memory Tests until interrupted. A new starting seed is used on each pass, causing the test patterns to vary for each test. A running total of the number of test passes performed and the total number of errors found is displayed between each pass.

Arbitrated Read Tests

Does continuous emulation memory reads until interrupted. This test maintains a count of the number of arbitration time-outs during the reads. The purpose of this test is to verify that the selected arbitration method is compatible with the target. **To have any meaning, valid code should be uploaded to *Uni*ROM and the target should be allowed to execute that code during this test.** If the target continues to run without error and this test shows NO arbitration time-outs, then the selected arbitration method is compatible with this target. If target execution fails or arbitration time-outs are reported, try

increasing the Arbitration Time-out parameter. If increasing the time-out value does not help, then a different arbitration method should be selected.

Non destructive, arbitrated memory tests

This is a more demanding arbitration test. It performs a non-destructive memory test on the emulation memory. For each memory location, the test reads the location, writes the same data back to that location, and then reads the location again and verifies that it matches the original data read. We recommend that you perform the previous test before proceeding to this one. Again, for this test to have any meaning, the target should be executing code from the emulator during the test. Note that this test will FAIL at random intervals if the target is modifying this memory during the test.
This does NOT mean that arbitration is failing, bur rather indicates that the test conditions are invalid. Whenever the target WRITES new data to a location during the interval between UniROM's first and second read, UniROM will report a read error (since the second read did not match the first read).

Main menu

Displays the MAIN menu.

Setup Memory Organization

The options in this menu determine how the target views *Uni*ROM's emulation memory. This should be configured BEFORE any WATCHES, VCOM or URCOM addresses are configured. Changing the memory organization affects how specific addresses are mapped into the emulation boards and may therefore invalidate WATCH, URCOM and VCOM address configurations.

One 8 bit Device

Configures *Uni*ROM to use the LOWER emulation board only. The upper board is ignored.

TWO independent 8 bit Devices

Configures *Uni*ROM to treat EACH memory board as separate devices. When this organization is selected, all memory READS, WRITES, FILLS and UPLOADS will be affect the currently "SELECTED" emulation board only. Each board has its own configuration parameters (Address, offset, type, arbitration method etc.). Either board can be "SELECTED" from the TRANSFER menu. Each board could be configured to operate at the same address, allowing for the possibility of emulating the RAM and the EPROM on a HARVARD-LIKE architecture like the 8031. Because of the possible ambiguity, Watches will require a BOARD (UPPER or LOWER) specification to determine which board the watch refers to.

16 bit INTERLEAVED Device

Configures *Uni*ROM to treat the two memory boards as EVEN/ODD interleaved. The LOWER board holds all EVEN data (Bytes 0,2,4...) and the UPPER board holds all ODD data (Bytes 1,3,5...). In this organization, the same setups (device size, type...) are used for BOTH devices. It is possible to READ, WRITE, FILL or UPLOAD to each board independently by selecting the UPPER or LOWER board before the operation. This allows for separate EVEN and ODD files to be UPLOAD separately and still have the target view the emulator in a 16 bit interleaved organization. When BOTH boards are selected, all memory accesses are automatically directed to the proper board based on whether the destination is an EVEN or ODD address. An external adapter (ADP16) can be used to combine the two emulation boards to emulate a single 16 bit EPROM/FLASH device.

Note that all address references are still REAL, LINEAR addresses. *Uni*ROM takes care of adjusting for the interleaving. For example to read 4 bytes starting at address 0x1000, *Uni*ROM will read the Byte at location 0x800 in the LOWER board, then the Byte at location 0x800 in the UPPER board, then location 0x801 in the LOWER board and finally location 0x801 in the UPPER board.

Byte-swap Interleaved

This option is identical with INTERLEAVED except the lower board holds the ODD bytes and the UPPER board holds the EVEN bytes. This allows for easy target connections, regardless of which target socket holds the ODD or EVEN data. It also allows for easy Big/Little Endian adjustments.

Current settings

Displays the current settings for the Interrupt line.

Setup menu

Returns to the Setup Menu.

Main Menu

Returns to the Main Menu.

Setup Emulation Memory

8 bit *Uni*ROM's offer this single setup menu to configure ALL emulation memory related options. 16 bit *Uni*ROM's use this same menu for "Single 8 BIT" configurations and "Single 16 BIT (INTERLEAVED) configurations. When a 16 bit *Uni*ROM is configured for "TWO 8 BIT DEVICES", this menu is replaced with an UPPER Emulation Memory menu and a LOWER Emulation Memory menus. All three configurations offer the same options and will be discussed collectively below.

Bank Shadowing

Selects Bank Shadowing as the current arbitration method. This method works in nearly ALL situations and is therefore the default. The remaining arbitration methods are included to handle cases in which the target rarely accesses emulation memory (but could at any time) or never releases it.

Interleaving or Ready

Selects READY arbitration or Cycle-Interleaving as the current arbitration method. If the READY line is connected to the target, target cycles are stretched during collisions to affect arbitration. If READY is NOT connected, the target access times must be at least twice as long as *Uni*ROM's access time so that Cycle-Interleaving will work.

Grant or External Enable

Selects REQUEST/GRANT or EXTERNAL ENABLE arbitration as the current arbitration method.
In Request/Grant arbitration, *Uni*ROM asserts the REQUEST line whenever a HOST cycle is pending, and waits for a GRANT from the target before proceeding. Upon completion of the HOST access, the REQUEST line is released.
In External Enable arbitration, *Uni*ROM watches the External Enable line to determine when it is safe to start a HOST access. The External Enable line is connected to a target signal that is NEVER active at the same time *Uni*ROM is being accessed by the target. The chip select from another memory chip or an I/O command line are typical candidates. The selected signal must be active for at least *Uni*ROM's access time.

No arbitration

Specifies that NO ARBITRATION should be used for emulation memory access. If this option is selected, the HOST will ALWAYS gain immediate access to the memory. The target will fetch garbage. This approach may be appropriate in some look-up table applications in which the target is not executing code from *Uni*ROM and an occasional bad fetch can be tolerated. Many engine controllers, video controllers and general process controllers use a separate EPROM to store such tables and fall into this category.

Noise filter [ON|OFF]

Specifies that the start of HOST cycles are delayed until approximately 10ns after the target cycle has started. Some targets will drive the address lines and the /CS line at the same time. Differences in loading or line settling time may cause the addresses to change AFTER /CS is asserted. When this option is enabled, *Uni*ROM allows extra address settling time before deciding which bank the target is accessing, and therefore whether or not to start any pending HOST access. This adds more noise immunity.

Arbitration time-out

Specifies the amount of time the hardware will wait for an arbitrated access to complete before aborting a HOST access cycle. If *Uni*ROM reports arbitration time-outs during arbitrated accesses, this parameter should be increased. If arbitration time-outs continue, try using another arbitration method or change the Delayed Host Cycle state.

EPROM

Specifies that the target connection should be configured for JEDEC standard 24, 28 and 32 pin EPROMs.

Flash

Specifies that the target connection should be configured for 32 pin FLASH devices.

Address

Sets the starting address of the device being emulated. This can be left at 0 if desired. However, if it is set to match the actual starting address of the device, then real addresses can be used to reference device reads, writes, watches and virtual UART locations.

Length

Sets the emulated device size in KBytes. NOTE: NO error checking is performed to insure that enough memory exists to emulate a device of the indicated size.

EXAMPLES:

"L 64" specifies a 64KByte device (27C512,28F512...).
"L 512" specifies a 512KByte device (27C040,29F040...).

Current settings

Displays the current settings.

Setup menu

Returns to the setup menu.

Main menu

Returns to the main menu.

Setup Lower Emulation Memory

This menu is presented only if Memory Organization is set to TWO independent devices on a 16 bit *Uni*ROM. Refer to the "Setup Emulation Memory" menu for details.

Setup Upper Emulation Memory

This menu is presented only if Memory Organization is set to TWO independent devices on a 16 bit *Uni*ROM. Refer to the "Setup Emulation Memory" menu for details.

Setup Reset

Bipolar driver

Uses a BIPOLAR or TOTEM-POLE driver for the Reset line. When Reset is active, the reset line is driven to the active level. When Reset is in-active, the reset line is drive to the opposite state.

Tri-state driver

Uses a TRI-STATE driver for the reset line. When reset is activated, the reset line is driven to the active state. When Reset is in-active, the reset line is NOT DRIVEN, allowing it to float. This is the default configuration and is appropriate for connecting to the target's reset switch or RC reset circuit.

High active level

Specifies that the Reset line should be driven to a HIGH level to activate reset on the target.

Low active level

Specifies that the Reset line should be driven to a LOW level to active reset on the target.

Current settings

Displays the current settings for the Reset line.

Setup menu

Returns to the Setup Menu.

Main Menu

Returns to the Main Menu.

Setup Interrupt

Bipolar driver

Uses a BIPOLAR or TOTEM-POLE driver for the Interrupt line. When Interrupt is active, the Interrupt line is driven to the active level. When Interrupt is in-active, the Interrupt line is drive to the opposite state.

Tri-state driver

Uses a TRI-STATE driver for the Interrupt line. When Interrupt is activated, the Interrupt line is driven to the active state. When Interrupt is in-active, the Interrupt line is NOT DRIVEN, allowing it to float. This is the default configuration.

High active level

Specifies that the Interrupt line should be driven to a HIGH level to activate an Interrupt on the target.

Low active level

Specifies that the Interrupt line should be driven to a LOW level to active an Interrupt on the target.

Current settings

Displays the current settings for the Interrupt line.

Setup menu

Returns to the Setup Menu.

Main Menu

Returns to the Main Menu.

Setup Watches

Address

Specifies the address to watch for a specific Watch-point. If the Device-Address was configured properly, this refers to an actual target address (which must land within *Uni*ROM's emulation memory). If the Device-Address was left at 0, this address refers to an offset within the emulation memory. In 16 bit *Uni*ROMs configured for "TWO INDEPENDENT 8 BIT DEVICE", add UPPER or LOWER after the address to indicate which board the watch belongs to.

Enable

Enables a specific Watch-point. Only enabled Watch-points, are displayed during a WATCH operation.

Disable

Disables a specific Watch-point. Disabled Watch-points are skipped during a WATCH operation.

Length

Specifies the number of bytes to watch for this Watch-point. Up to 8 contiguous bytes may be watched at each Watch-point.

Current settings

Displays the current settings for these parameters.

Setup menu

Returns to the Setup Menu.

Main

Returns to the Main Menu.

Setup Transfers

Binary format

Specifies that uploads are in Binary format. NO conversions are performed on the data.

Motorola formats

Specifies that uploads are in one of the Motorola HEX formats. All Motorola formats are supported.

Intel formats

Specifies that uploads are in one of the Intel HEX formats. All Intel HEX formats are supported.

Tektronix formats

Specifies that uploads are in one of the Tektronix formats. All Tektronix formats are supported.

Upload initial time-out

Specifies how long (in seconds) *Uni*ROM will wait for an upload to start, before timing-out.

Load Address

When uploading BINARY files, this parameter specifies the absolute address to begin loading the data. This can be useful for placing multiple BINARY images into memory at different locations.

When uploading HEX files, this parameter specifies a default starting address to use as a reference for locating the HEX file. Most HEX files have embedded address information which will over-ride this setting. This is usually set to the starting address of the EPROM or the starting address of code image (they might be different). Since this is simply a default setting, most HEX files will load correctly, regardless of what value is entered in this parameter.

Auto-reset

When enabled, specifies that *Uni*ROM should assert RESET and over-ride the current arbitration method during all Uploads Verifies and Fills. All other operations continue to use the configured arbitration method for emulation memory accesses. Normally, one would want to reset the target during these operations, so this is enabled by default.

Transmit Pacing

Specifies relative delays *Uni*ROM should place between characters transmitted TO the HOST. *Uni*ROM is capable of maintaining a full 115KBAUD data rate during transfers. This can over-run many terminal emulation programs (including URTERM) on some machines, particularly when running in a DOS box under WINDOWS. If you are dropping characters while viewing menus or watches, you can increase this parameter. This will slow down the character stream FROM *Uni*ROM TO the HOST, but will NOT slow down data FROM the HOST to *Uni*ROM. This option allows one to continue using a high BAUD rate for quicker uploads.

Current settings

Displays the current settings for these parameters.

Setup menu

Returns to the Setup Menu.

Main

Returns to the Main Menu.

Setup Console

SERIAL target

Specifies that the Serial HOST port should be associated with the Serial OUT port.

URCOM option board

Specifies that the Serial HOST port should be associated with the URCOM board.

VCOM

Specifies that the Serial HOST port should be associated with VCOM.

NONE

Specifies that the Serial HOST port is not associated with a Console Path.

Address

Specifies the base address of VCOM or URCOM(when enabled). This refers to the actual physical address the target will use to reference VCOM or URCOM.

Interrupt

Specifies when *Uni*ROM should activate the INTERRUPT line. If RX is selected, *Uni*ROM will generate an interrupt anytime it sends a character to URCOM or VCOM. If TX is selected, *Uni*ROM will generate an interrupt anytime it receives a character from URCOM or VCOM. If BOTH is selected, *Uni*ROM will generate an interrupt in either situation. Of course if NONE is selected, *Uni*ROM will NOT generate interrupts.

BAUD rate

Specifies the BAUD-RATE used for the CONSOLE connection.
NOTE: This can be different than your current BAUD-RATE. If you connected to *Uni*ROM through the serial port, *Uni*ROM automatically adjusted its BAUD-RATE to match yours. If this option is set to a different rate, and you select CONSOLE from the main menu, you will not be able to talk to the console path from the terminal emulator because your rate is different than *Uni*ROM's CONSOLE baud rate. This feature allows for high bandwidth loads and verifies while maintaining the ability to CONSOLE to debuggers which run at slower rates.

1200

2400

4800

9600

19.2K

38.4K

57.6K

115.2K

Sets the CONSOLE BAUD RATE to the selected value

Current settings

Displays the current settings for these parameters.

Setup menu

Returns to the Setup Menu.

Main

Returns to the Main Menu.

Setup UDX

Controls loading, verifying and activating UniROM Debugger eXtensions (UDXs).

Upload

Initiates loading of a UDX into *Uni*ROM memory.

Verify

Verifies that a valid UDX is present in memory.

Enable UDX

Activates the UDX if it is present and valid. The UDX may or may not return control to you, depending on its purpose and to which port you are connected. UDXs are generally invoked from a script command or Library function.

Disable UDX

De-activates the UDX.

Setup menu

Returns to the Setup menu.

Main menu

Returns to the Main menu.

Chapter 13: 16 bit *Uni*ROM Issues

16 bit *Uni*ROMs consists of a single HOST interface board and two completely independent emulation boards. *Uni*ROM firmware allows considerable flexibility in how these boards are used. The upper emulation board can be completely ignored if 8 bit emulation is desired. *Uni*ROM can even treat the emulation boards as two completely independent devices, each with its own configurations. In addition, *Uni*ROM can treat these boards as an ODD/EVEN or EVEN/ODD pair for 16 bit interleaved operation. This considerable flexibility adds many new configuration parameters and operating scenarios. This chapter discusses the issues specific to 16 bit *Uni*ROMs. It does not re-hash the issues common to 8 bit *Uni*ROMs. One should still read the first three chapters to get started.

We are concerned with configuration and use of 16 bit *Uni*ROMs under all scenarios. The added complexity of these new parameters and operating modes could become very cumbersome. *Uni*ROM keeps things manageable by maintaining a clean separation between the configuration issues and the operation issues. It is important to understand this separation.

CONFIGURATION

*Uni*ROM uses a single SETUP parameter to tell it how you intend to use the memory emulation boards. Your selection for this setting will usually be dictated by how the target views the devices *Uni*ROM is emulating. This parameter is very static; your target will not change it view of its memory map. This configuration is called the MEMORY ORGANIZATION. Valid Options are:

SINGLE 8 bit device
DUAL Independent 8 bit Devices
Even/Odd Interleaved
Odd/Even 16 bit Interleaved

The SINGLE 8 Bit device setting allows us to completely ignore the UPPER memory board. This setting locks-out any access options to the UPPER board. All memory accesses act on the lower emulation board.

The DUAL Independent 8 bit setting may be appropriate if you are emulating 2 devices in an 8 bit system, such as a BOOT ROM and a separate APPLICATION ROM. This would also allow a single 16 *Uni*ROM to emulate a single 8 bit ROM in each of two targets. This option tells *Uni*ROM to maintain completely separate configuration (size, address, type...) information for each emulation board. When this option is selected, *Uni*ROM will allow access to either board, but not interleaved access to BOTH boards.

The 16 bit Interleaved options tells *Uni*ROM that two identical devices are used in a 16 bit interleaved fashion. This is appropriate for targets that us ODD and EVEN EPROMs. When one of these modes is selected, *Uni*ROM allows individual access to either individual board or interleaved access to BOTH boards. When accessing BOTH boards, *Uni*ROM handles all address translations to access the correct offset within the correct memory board for the requested byte.

If you selected DUAL INDEPENDENT 8 bit Device, you will need to configure the UPPER memory emulation board as well as the LOWER board. Separate, but identical parameters are used for this configuration.

Script Configuration

Include the following line in the CONFIGURATION section of your script file:

ORGANIZATION org

where “org” is SINGLE, DUAL, Even/odd or Odd/even.

If you selected DUAL, you will also need to add configuration lines for the UPPER DEVICE and possibly the UPPER ARBITRATION. These definitions use the exact same parameter syntax as the normal versions (without the keyword prefix UPPER).

ASCII Interface Configuration

16 bit *Uni*ROMs add a MEMORY ORGANIZATION option to the SETUP menu. This should be the FIRST item configured. *Uni*ROM uses this information to determine how to interpret address references in other setup items (like WATCH addresses).

If you configure UniROM for DUAL 8 bit mode, the top level SETUP menu will change to offer two submenus for emulation memory setup; one for the LOWER board and one for the UPPER board. SINGLE 8 bit mode and either of the Interleaved modes will cause the top level SETUP menu to present a single submenu.

OPERATIONS

*Uni*ROM uses the concept of a modal TRANSFER MODE. The transfer mode is set by a TRANSFERS command. Once a transfer mode is defined, it stays in effect until another TRANSFERS is issued. The current transfer mode tells *Uni*ROM how to access the emulation memory. The valid transfer mode options depend on the MEMORY ORGANIZATION setting as shown below:

Memory Organization	Valid Transfer Modes
SINGLE 8 BIT:	(no valid options)
DUAL 8 BIT:	LOWER, UPPER
EVEN/ODD INTERLEAVED:	LOWER, UPPER, BOTH
ODD/EVEN INTERLEAVED:	LOWER, UPPER, BOTH

Note that the TRANSFERS command is not valid if the MEMORY ORGANIZATION is set to SINGLE 8 bit mode and that BOTH is only valid for INTERLEAVED configurations.

*Uni*ROM uses the current transfer mode to determine how to treat the emulation board for any accesses to emulation memory. The TRANSFERS command tells *Uni*ROM if it should act on the UPPER, LOWER or BOTH emulation boards for any read, write, load or verify operations. If one selects BOTH, all memory accesses will then treat the boards as an interleaved pair, with ODD bytes in one board and EVEN bytes in the other board. If we then did a TRANSFERS LOWER command, our memory accesses would act only on the LOWER board, which may hold the ODD or the EVEN data, depending on the MEMORY ORGANIZATION configuration.

This extreme flexibility allows us to load separate ODD and EVEN files into individual boards, then select BOTH and view the resulting “shuffled” files as the target sees them.

Script Commands

Place a TRANSFERS command at the top of the COMMAND section of your script file. All loads, verifies, fills, etc. following that command will access the board(s) it selected. Additional TRANSFERS commands can be placed in the script to access individual boards as desired. See Chapter 8 on "ADVANCED SCRIPTS" for an example of this concept.

ASCII Interface Commands

All memory accesses are initiated in the TRANSFERs menu. This menu offers a SELECT command whenever MEMORY ORGANIZATION is set to anything but SINGLE 8 bit mode. Use this command to select the desired board. All TRANSFER menu commands will act on the SELECTED board(s) until another SELECT command is issued.

Target Write-back

Several things can go wrong when attempting to write to *Uni*ROM from the target side. Some targets are incapable of writing to the socket *Uni*ROM is plugged into. Decode logic may lock out WRITES to this address space. Some targets will place uni-directional buffers between the EPROM socket and the CPU data bus, making it impossible to WRITE to the socket.

Targets with EVEN/ODD interleaved EPROMs will often use a single chip select for BOTH EPROMs, making it impossible to do BYTE level access to the EPROMs. This is reasonable for CODE fetches, but can corrupt memory during WRITEs. To do individual BYTE writes to a 16 bit *Uni*ROM, the target MUST qualify its chip selects. This is not a special limitation imposed by *Uni*ROM, but rather a simple design consideration. Even targets with two FLASH chips will often use a single chip select for BOTH chips, assuming that they will always write WORDs to this space during a code update. Most debuggers will write individual BYTES into the code space during debug. Others are configurable.

Also note that there is only ONE external WRITE input on the feature connector. *Uni*ROM uses this input for the WRITE signal when it is configured to plug into EPROM sockets. This means that it is NOT possible for a target to write back to *Uni*ROM if it is emulating two separate EPROMs IN TWO SEPARATE TARGETS. This is not an issue if those targets are using FLASH, since each target will provide its own chip select and write signal through the FLASH socket.

Big vs. Little Endian

*Uni*ROM is not particularly concerned with the byte ordering (ENDIANISM?) of the target processor. It splits files according to its MEMORY ORGANIZATION parameter. The user may change this configuration between ODD/EVEN and EVEN/ODD to force the EVEN bytes into a specific emulation board and the ODD bytes into the remaining board. This choice is determined by the byte ordering of the data, the physical positioning of the target sockets and the wiring of the memory device(s). When dealing with two interleaved 8 bit devices, one choice would result in an easy target cable installation, the other choice may cause the cables to cross, resulting in a very difficult installation.

The only important question is: In which emulation board do you want the EVEN bytes to reside? We define the EVEN bytes as bytes 0,2,4,6... Put another way, if you were to convert the file to an EPROM IMAGE, the first CHARACTER (8bits) from that file would be an EVEN BYTE.

If this is still confusing, SIMPLY TRY EACH SETTING! One is right for you situation, the other one is wrong.

Chapter 14: Using Multiple *Uni*ROMs

Multiple *Uni*ROMs can be controlled from a single serial or parallel HOST port. We use a daisy-chain configuration to connect multiple *Uni*ROMs to a SERIAL port and a MULTI-DROP configuration when connecting to a parallel port. Regardless of which port is used, the user interfaces, script commands and Library commands remain the same. The underlying link level protocols for each port are quite different, but those differences are isolated to the lowest level software and firmware routines. This approach insures that *Uni*ROM functions consistently, regardless of the communications path chosen.

Before connecting the *Uni*ROMs together, we need to assign a unique ID to each unit. This enables us to SELECT an individual unit for loading etc. This is covered in the following section.

Setting the IDs

All *Uni*ROMs have a factory default ID of 1. If we connect multiple *Uni*ROMs together without assigning unique IDs, they will ALL attempt to respond to ALL commands, resulting in chaos. We use URTERM to set a *Uni*ROM's ID as follows:

Connect a Serial or Parallel cable between the HOST and *Uni*ROM as described in Chapter 1.
CONNECT ONLY ONE *Uni*ROM AT THIS TIME.

For PC HOSTS: Start URTERM as follows:

```
URTERM   script_file
```

Where "script_file" is any script file that contains a valid PORT definition. The TEST.CFG file from Chapter 1 should be valid unless you have changed ports since then.

For NON-PC HOSTS: Start your terminal emulator program and gets *Uni*ROM's attention as described in Chapter 11 - "NON-PC Support".

Change to the SETUP menu and select "UNIROM ADDRESS".
Enter a one or two digit HEX number. This number can NOT be 0. Valid entries are 2 - FF.
Select "STORE CONFIGURATION IN EEPROM" to store this configuration in EEPROM.

For PC HOSTS: Press ALT-X to exit URTERM.

Disconnect this *Uni*ROM from the HOST port.

Repeat this procedure for each *Uni*ROM, assigning a different ID to each.

Connecting the Cables

Once EACH *Uni*ROM has been assigned a unique ID, we can connect the cables.

Serial Daisy-chain

Connect the FIRST *Uni*ROM to the HOST as instructed in Chapter 1. The second *Uni*ROM is simply "Daisy-chained" as follows.

Using the 8 wire modular cable supplied with the second *Uni*ROM, connect the SERIAL OUT port from the first *Uni*ROM to the SERIAL IN port of the second *Uni*ROM. Additional *Uni*ROMs are connected in the same manner. This is illustrated in Figure 10 below:

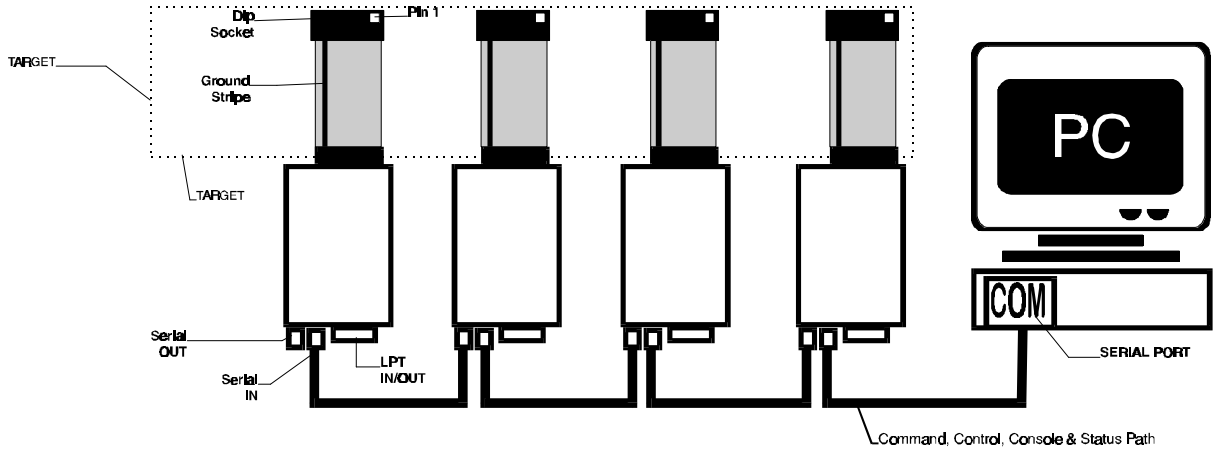


Figure 10 - Serial Daisy-chain Connections

Parallel Muli-Drop

Connecting multiple *Uni*ROMs to a parallel port requires a MULTI-DROP ADAPTER for the each *Uni*ROM except the last one. For example, if you are connecting 4 *Uni*ROMs together, you will need 3 adapters. These adapters create a MULTI-DROP configuration in which all *Uni*ROMs are placed in parallel. Connect the *Uni*ROMs and cables as shown in Figure 11 below.

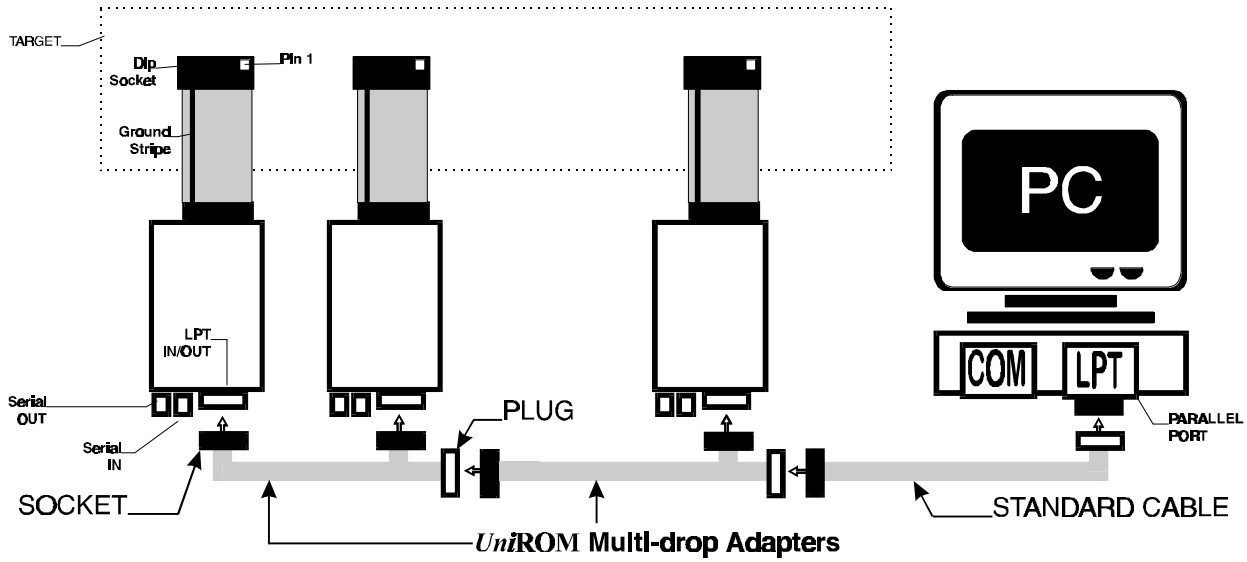


Figure 11 - Parallel Multi-drop Connections

Changes to Script Files

Supporting multiple *Uni*ROMs from script files is easy. Simply add additional CONFIGURATION sections for each added *Uni*ROM and then use SELECT commands in the COMMAND section to communicate with individual units. These additions are discussed below.

CONFIGURATION Section

*Uni*ROM scripts support multiple CONFIGURATION sections. Each section contains the configuration for a single *Uni*ROM. The section header [CFG XX] tells the loader which *Uni*ROM this information is for. The following example demonstrates this.

```
[HOST]
PORT  COM2

[CFG 2]
DEVICE   128   E0000 EPROM
RESET     LOW   TRI-STATE

[CFG 3]
ORG       EVEN/ODD              // lower board EVEN, upper board ODD
DEVICE   64    80000 FLASH      // EACH device a 64KByte FLASH

[CFG 4]
ORG    DUAL                     // two independent devices
DEVICE  64  0  FLASH            // lower board is a 64KByte FLASH
UPPER DEVICE 128  EPROM         // upper board is a 128 KByte EPROM

[CMD]
......
```

NOTE that in the examples that assume a single *Uni*ROM, we used "[CFG]" for the configuration header. This told the loader to use a default ID of 0. Zero is a special ID which ALL *Uni*ROMs will respond to, regardless of their true ID. When using multiple *Uni*ROMs, we specify specific IDs. When multiple *Uni*ROMs are used, an ID MUST be specified for each CONFIGURATION section. DO NOT USE an ID of 0 or the assumed ID 0 syntax ([CFG]). In addition, an ID of 1 should not be used except as indicated in the CONSOLE ISSUES section below.

COMMAND Section

*Uni*ROM scripts support a SELECT command in the COMMAND section. The SELECT command allows us to select a single *Uni*ROM on the chain. The following example is a continuation of the previous section.

```
[CMD]
SELECT 2                  // Conect to UniROM # 2
RESET ON                  // we use this unit to control the target reset
LOAD BIN  app1.bin  E0000

SELECT 3                  // Connect to UniROM #3 (16 bit unit)
TRANSFERS BOTH            // use BOTH boards for the following commands
RESET ON                  // RESET, even if it is not connected to the target.
                          // Assures full speed access to emulation memory
LOAD HEX   app2.hex   80000
TRANSFERS  LOWER    // Load an EVEN file into LOWER board only
LOAD BIN  even.bin    90000
TRANSFERS UPPER       // Load an ODD file into UPPER board only
LOAD BIN  odd.bin     90000
RESET OFF

SELECT 4                  // Connect to UniROM # 4
TRANSFERS LOWER     // Access the LOWER emulation board ONLY
RESET ON
LOAD  BIN app3.bin  0
TRANSFERS UPPER       // Access the UPPER emulation board ONLY
LOAD  BIN  app4.bin  0
RESET OFF

SELECT 2
RESET OFF                 // done, let the target GO!
```

CONSOLE Path Considerations

Console connections are always made through he SERIAL connection. *Uni*ROM control, status and file operations can be performed through either connection. Because of this distinction, there are a few system wide differences between serial and parallel connection on multiple *Uni*ROMs when doing CONSOLE operations. When doing CONSOLE connections, there are two major configurations; SERIAL only and BOTH serial and parallel. Each are covered below.

Serial Only

CONSOLE connections in a serial only configuration operate exactly the same with multiple *Uni*ROMs as with a single *Uni*ROM. Just as with a single *Uni*ROM, the CONSOLE command must be the LAST command in the script file because we are still using a single communications link for the CONSOLE path and *Uni*ROM control and status.

The CONSOLE connection should be made through the FIRST *Uni*ROM in the chain. This would be the unit connected directly to the HOST port. This would seem to eliminate the possibility of CONSOLEing to the SERIAL OUT port, since it is being used to daisy-chain. We have a solution.

When daisy-chaining multiple *Uni*ROMs and using a CONSOLE path to the serial OUT port, do the following:

1. Set the ID of the LAST *Uni*ROM in the chain to 1.
2. Connect the SERIAL OUT port of the last *Uni*ROM to the target's serial port.
3. Establish the CONSOLE path in the LAST *Uni*ROM in the chain

Note that these instruction are contrary to all earlier recommendations. The ID of 1 is a special flag to tell the *Uni*ROMs to configure for this special setup.

Serial and Parallel

When both ports are connected, the serial port is used for CONSOLE connections and the PARALLEL port is used for fast *Uni*ROM transfers, control and status. This simplifies the system by providing separate communications paths for the CONSOLE and *Uni*ROM control. The parallel link is connected in a MULTI-DROP configuration. A single connection is made between the HOST SERIAL port and the SERIAL IN port on any *Uni*ROM in the chain. Since that *Uni*ROM's serial OUT port is not being used for daisy-chaining, it can be used as a console path if desired without any special setups.

Since separate communications paths are being used for CONSOLE and *Uni*ROM control, the CONSOLE command can occur anywhere within the script (after a SELECT command to the appropriate *Uni*ROM)..

Appendix A - Troubleshooting Tips

Failure to communicate with Uni*ROM*

Incorrect port selection

On NON-PC HOSTs verify verify that the terminal emulator is configured for the correct serial port and paramters described in Chapter 11. PC HOSTs should verify the PORT definition in the script file as described in Chapter 1

Serial Port in CONSOLE Mode

The Serial HOST port may seem to be unresponsive if the port is in CONSOLE mode. If the HOST status LED flashes when you press the enter key, but doesn't respond, try pausing for at least 2 seconds and then pressing the + key three times. *Uni*ROM should respond with "OK".

Handshake lines incorrect.

*Uni*ROM uses hardware handshake lines for flow control. The terminal emulator settings and *Uni*ROM's configuration must match. If these do not match, the terminal emulator may not transmit at all, or may drop characters. *Uni*ROM defaults to RTS/CTS for flow control. URTerm and URLoad use RTS/CTS for flow control.

Using Parallel port I/F on a NON-PC HOST.

The parallel interface on *Uni*ROM is designed to communicate with URTerm or URLoad on a PC. It DOES NOT support other HOSTs because we use the status lines to read data back from *Uni*ROM in a nibble mode. The Centronics specifications do not allow for data read-back.

Arbitration Time-out Messages During Uploads and Verifies.

Auto Reset is OFF

In most situations, AUTO-RESET should be set to ON. This forces RESET and over-rides arbitration. Even if arbitration is configured properly, it could fail if the target is "in the weeds". Auto-RESET-ON insures that we get good uploads, regardless of the target's current state.

Incorrect arbitration method selected

Occasionally one may wish to perform uploads with arbitration. For example, you may want to upload data tables while the target is running. In these situations, you would turn AUTO-RESET OFF. If arbitration time-out messages appear, either the current arbitration method is incompatible with the target timing, or the target has died, leaving the EPROM permanently enabled or disabled.

Verify Errors

File too large.

If the file is larger than the Device Length, the data will "wrap-around" and over-write the beginning of the memory.

VCOM port is enabled

When CONSOLE mode is enabled and linked to the VCOM port, 4 bytes of memory become a VIRTUAL UART instead of RAM. This will cause a verify error since those bytes no longer hold the value uploaded to them. If you want to get a valid VERIFY, upload and verify the file before enabling CONSOLE mode. ONCE VCOM IS ENABLED, the 4 bytes at its address are modified!

Auto RESET is OFF.

In most situations, AUTO-RESET should be set to ON. This forces RESET and over-rides arbitration. Even if arbitration is configured properly, it could fail if the target is "in the weeds". Auto-RESET-ON insures that we get good uploads, regardless of the target's current state.

If running the loader under Windows, you may be dropping characters. See the "DROPPING CHARACTERS note below.

Uploads and Verifies but target doesn't run.

Reset not connected or configured incorrectly

When new code is uploaded, the processor needs to be reset to initialize properly. If the reset line is configured and connected properly, *Uni*ROM will hold the target in reset during the upload, and then release it. If cycling power on the target makes it start working properly, then the RESET is not having an affect. Verify the configuration parameters and the target connection point or simply cycle target power after each upload.

Device Length set incorrectly.

The Device Length should be set to match the Device being emulated. If this parameter is set too large, *Uni*ROM will enable address lines that may not be connected to the memory socket, resulting in floating address inputs. This will cause random misreads and therefore execution failures. If the Length is set too small, the code may upload and verify (if it is small) but may not execute because it has been located incorrectly.

Code loaded at incorrect location

Use the READ command from the Transfer menu to verify that the code looks like it is located properly. Miss-located code may VERIFY OK, but will not execute. If the code is not located where you expected, try changing the Address parameter in the Setup/Device menu and/or the OFFSET parameter in the Setup/Transfers menu.

Device Type set in-correctly.

The Device Type must be configured to match the type of device the target was designed to accept. If the target is configured for EPROMs, then *Uni*ROM must be configured for EPROMs as well.

Wrong data format.

Even incorrect, unexecutable data (say... the Gettysberg Address) can be uploaded and verify correctly. The Verify command simply compares the emulation memory contents with the data file. It does NOT try to interpret the data to see if it consists of valid OPCODES for any particular processor.
The most common mistake is to configure *Uni*ROM to expect BINARY data, and then to send a formatted HEX file to it. Notice that the Gettysberg Address MAY be valid Binary data! If you READ a block of data after doing an upload and notice all HEX NUMBERS in the ASCII field, this is probably the problem.

File Too Large

A file may wrap around and corrupt low memory and STILL VERIFY OK if you are uploading BINARY files and using an offset. The data itself loads correctly and therefore verifies. However, it may be corrupting other important data at low memory.

VCOM port is enabled

The VCOM port replaces 4 bytes of emulation memory with a VIRTUAL UART. If VCOM is located at the wrong address, or enabled by mistake, it will corrupt 4 bytes of memory at its address.

Target Crashes during Reads, Writes or Watches.

Arbitration method set incorrectly.

The current arbitration method may not be compatible with the target timing. Select an appropriate arbitration method and test it from the Diagnostics menu.

Noise Filter HOST cycles ON/OFF.

The Bank Shadowing arbitration may work if the NOISE FILTER is turned ON or OFF. Try both before giving up on this method.

The Target has died.

Sometimes when a target acts up, it may stop fetching code completely or get stuck in a tight loop, executing out of some other memory space (real or otherwise). Either of these conditions will cause some arbitration methods to fail. Resetting the target should clear the problem. The defualt action in the event of an arbitration timeout is to assert RESET to the target. We assume that arbitration works while the target is healthy, and only timesout if the target has stopped fetching data from us. The most logical response is to stop the target and let you have access to its memory. If you would rather be notified of the timeout and have YOUR accesses fail, change this parameter to REPORT ERROR.

Uni*ROM looses its configuration when turned off.*

*Uni*ROM uses EEPROM to store its configuration items. However, changes to the defaults are NOT stored in EEPROM until specifically told to with the STORE command in the Setup menu. Unless "STORED", changes are temporary and lost when *Uni*ROM is turned off.

Reset, Interrupt and Control Lines Do Not Work

The Reset, Interrupt and Control lines are tri-stated whenever the target power is turned off. They will only be driven when the target voltage is above 4.1 Volts. Also note that by default, the reset line is configured as a tri-state driver.

VCOM Fails Initialization

*Uni*ROM verifies that it has access to the memory defined for the VCOM. An arbitration failure will cause it to fail initialization. The standard rules for arbitration apply during Console setup. Solutions:

Issue a RESET ON command at the beginning of your script
Setup Consoles while the target is executing and proper arbitration has been configured.
Select NONE arbitration.
Turn target power off during setup.
Turn AUTO-RESET ON

Dropped Characters on Serial Interface

HARDWARE HANDSHAKE LINES WRONG

*Uni*ROM is capable of sending characters at the full 115KBaud rate. Some HOSTs can drop characters under these conditions. Verify that the terminal emulator is configured to use CTS/RTS HARDWARE handshaking for flow control. If it does not support HARDWARE flowcontrol, you will need to increase *Uni*ROM's PACING delay parameter. This will allow full bandwidth transmits TO *Uni*ROM, while slowing down the data rate FROM *Uni*ROM. Alternatively you could reduce the BAUD RATE.

Verify that you are using the cable supplied with *Uni*ROM. Many extension cables will not connect the hardware handshake lines.

Running High BAUD rates under Windows

If you are running URLOAD in a DOS box under Windows, you may be dropping characters because of the the way Windows handles DOS programs and the Serial port.

You may need to do one or more of the following:

- Close other DOS boxs
- Increase the Priorities for the DOS box in which URLOAD is running.
- Check the EXCLUSIVE and BACKGROUND parameters for *Uni*ROM's DOS box.
- Run the DOS BOX in FULL-SCREEN mode.
- Increase *Uni*ROM's PACING DELAY
- Reduce the BAUD-RATE.

Upper board on 16 Uni*ROM does not work*

*Uni*ROM senses target power from the LOWER emulation board. Anytime the voltage at the LOWER board's target interface connector drops below 4.1Volts, *Uni*ROM floats all outputs on BOTH emulation boards. This means that the UPPER board CANNOT be used alone. If you are using a single board, it must be the LOWER board.

Appendix B - Connector Pinouts

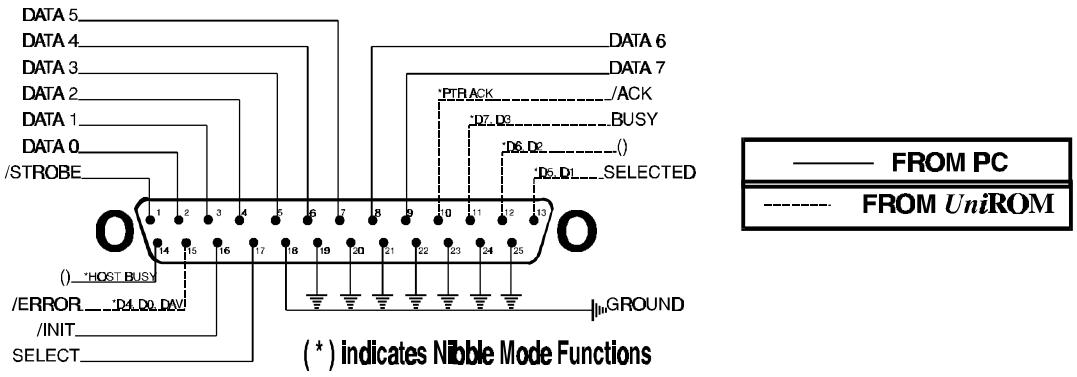
Power IN

On 8 bit *Uni*ROMs, the power in connector accepts a 3.5mm miniature plug. The TIP is connected to unregulated +8-9VDC and the Ring is connected to Ground.

On 16 bit *Uni*ROMs, the power in connector accepts a 2.5mm ID/ 5.5mm OD power plug. The center is connected to regulated +5VDC and the Ring is connected to ground.

Parallel Port I/F

The Parallel port uses a standard DB25-Male connector. It is pinned-out to mate directly with the DB25-Female connector used on PC printer ports. A straight-through 25 wire cable is used to connect the two. Its pin-out is shown below:

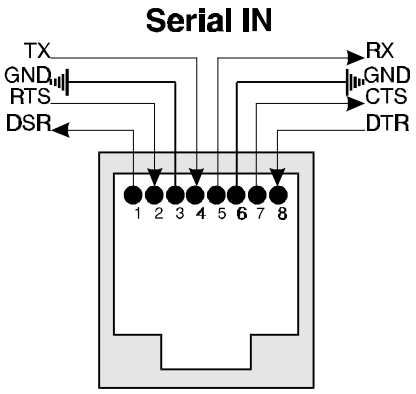


PIN #	Centronics Functions	SOURCE	Nibble Mode Functions
1	/STROBE	PC	-
2	DATA 0	PC	-
3	DATA 1	PC	-
4	DATA 2	PC	-
5	DATA 3	PC	-
6	DATA 4	PC	-
7	DATA 5	PC	-
8	DATA 6	PC	-
9	DATA 7	PC	-
10	/ACK	*Uni*ROM	PTR ACK
11	BUSY	*Uni*ROM	D7,D3
12	-	*Uni*ROM	D6,D2
13	SELECTED	*Uni*ROM	D5,D1
14	-	PC	HOST BUSY
15	/ERROR	*Uni*ROM	D4,D0,DAV
16	/INIT	PC	-
17	SELECT	PC	-
18-25	Ground	-	-

Serial IN Port

The Serial IN port is an RJ-45, configured as a DCE port (like a modem). The connector pin-out is shown below. Note that pin 1 on an RJ-45 is the left most pin, looking into the connector on *Uni*ROM.

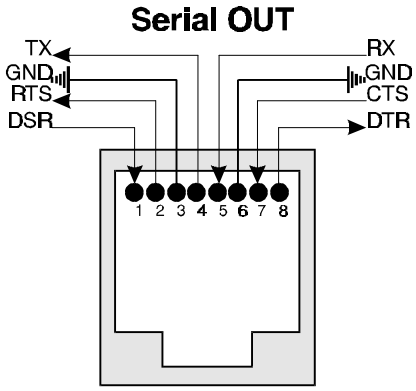
Pin #	Name	Source
1	DSR	*Uni*ROM
2	RTS	HOST
3	GND	-
4	TX	HOST
5	RX	*Uni*ROM
6	GND	-
7	CTS	*Uni*ROM
8	DTR	HOST



Serial OUT Port

The Serial OUT port is an RJ-45, configured as a DTE (like most computers).
The connector pin-out is shown below.

Pin #	Name	Source
1	DSR	HOST
2	RTS	*Uni*ROM
3	GND	-
4	TX	*Uni*ROM
5	RX	HOST
6	GND	-
7	CTS	HOST
8	DTR	*Uni*ROM

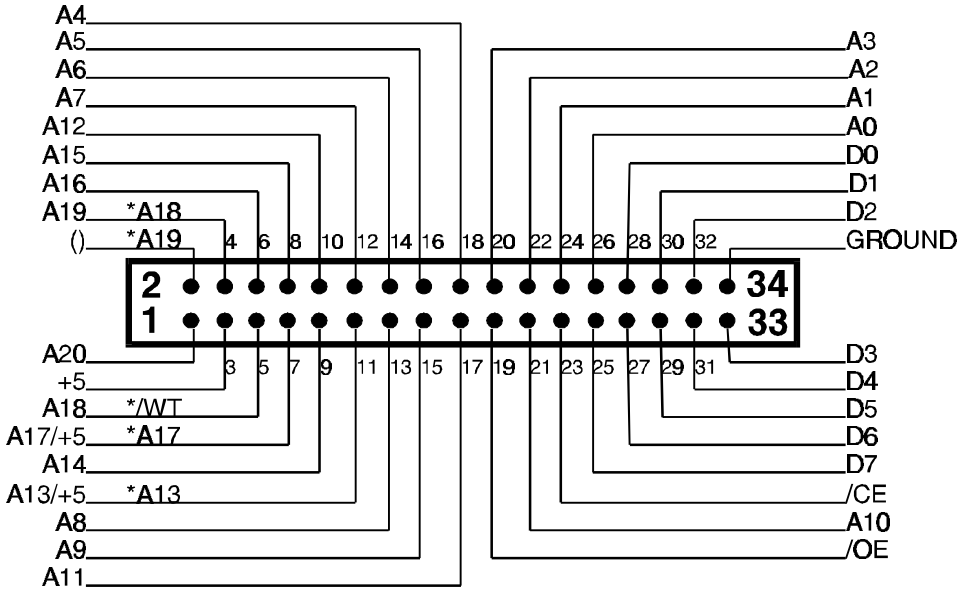


Target Memory I/F

The target interface connector is designed to support standard IDC connectors.
The connector pin-out is shown below.

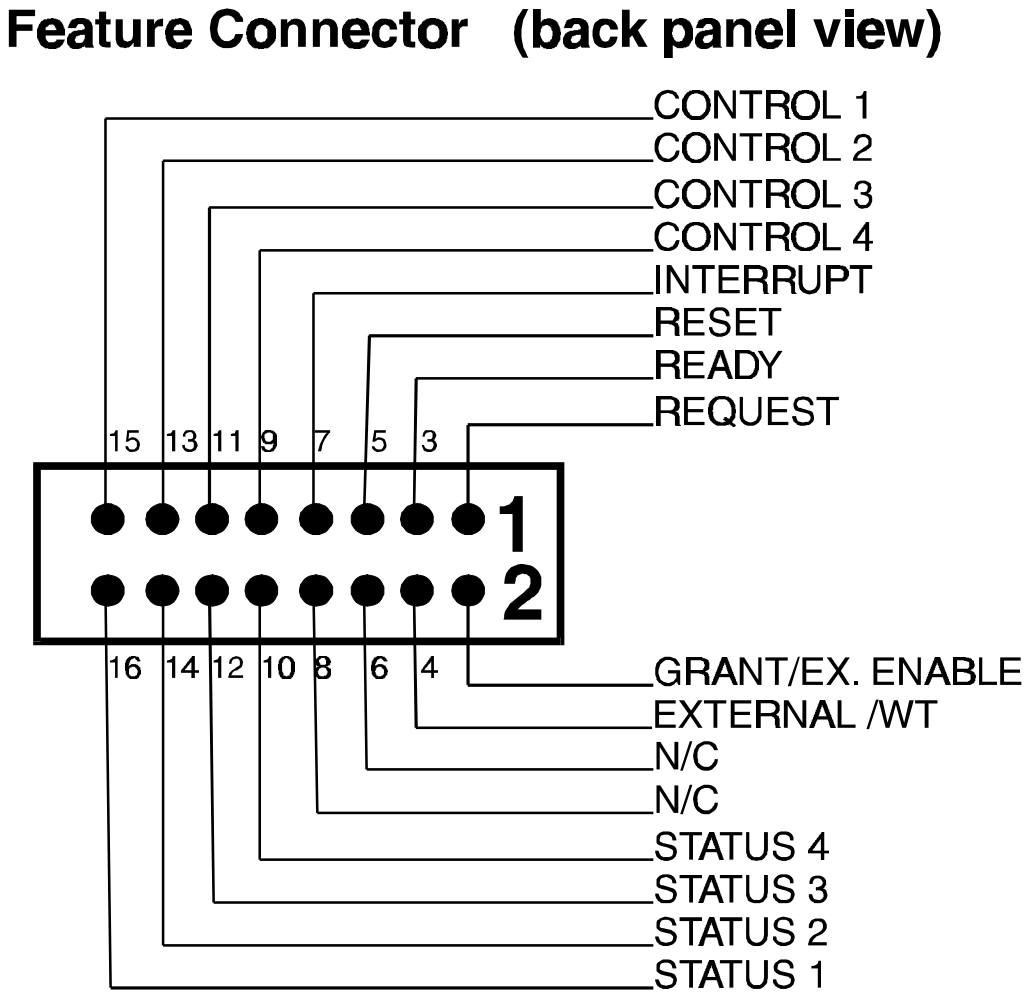
FLASH function	EPROM function	Pin #	Pin #	EPROM function	FLASH function
A19	-	2	1	A20	A20
A18	A19	4	3	+5	+5
A16	A16	6	5	A18	/WT
A15	A15	8	7	A17/+5	A17
A12	A12	10	9	A14	A14
A7	A7	12	11	A13/+5	A13
A6	A6	14	13	A8	A8
A5	A5	16	15	A9	A9
A4	A4	18	17	A11	A11
A3	A3	20	19	/OE	/OE
A2	A2	22	21	A10	A10
A1	A1	24	23	/CE	/CE
A0	A0	26	25	D7	D7
D0	D0	28	27	D6	D6
D1	D1	30	29	D5	D5
D2	D2	32	31	D4	D4
GND	GND	34	33	D3	D3

Target Memory I/F (back panel view)



(*) indicates FLASH pinout Exceptions

The top row are all *Uni*ROM outputs. The bottom row are all inputs to *Uni*ROM.
The feature connector pin-out is shown below:



Appendix C - HEX File Formats

Intel HEX

:xx xxxx xx xx

Byte Count	Address	Record Type	Data Bytes	Checksum
2 Hex digits (# of bytes in Data Fields)	4 Hex digits	00 - Data Record 01 - End Record 03 - Segmented Start Record 02 - Extended Address Record	2 Hex digits each	2 Hex digits (2's comp. SUM of the bytes in Byte count, Address, Record type, & Data Fields)

Motorola 'S'

Sx xx xxxx xx
Sx xx xxxx xx
Sx xx xxxxxx xx

Record Type	Length	Address	Data Bytes	Checksum
S0 - Start record	2 Hex digits (# of bytes in Address, Data , & Checksum Fields)	4 HEX Digits	2 Hex digits each	2 Hex digits (SUM of the bytes in Record length, Address, and Data Feilds)
S1 - Data Record S9 - END Record		4 HEX Digits		
S2 - Data Record S8 - END Record		6 HEX Digits		
S3 - Data Record S7 - END Record		8 HEX Digits		

Tektronix

/xxxx xx xx xx

Record Address	Byte Count	Header Checksum	Data Bytes	Data Checksum
4 HEX Digits	2 Hex digits (# of bytes in Data Feild)	2 Hex digits (SUM of the bytes in Address & Byte count Fields)	2 Hex digits each	2 Hex digits (SUM of all HEX digits in Data Field)

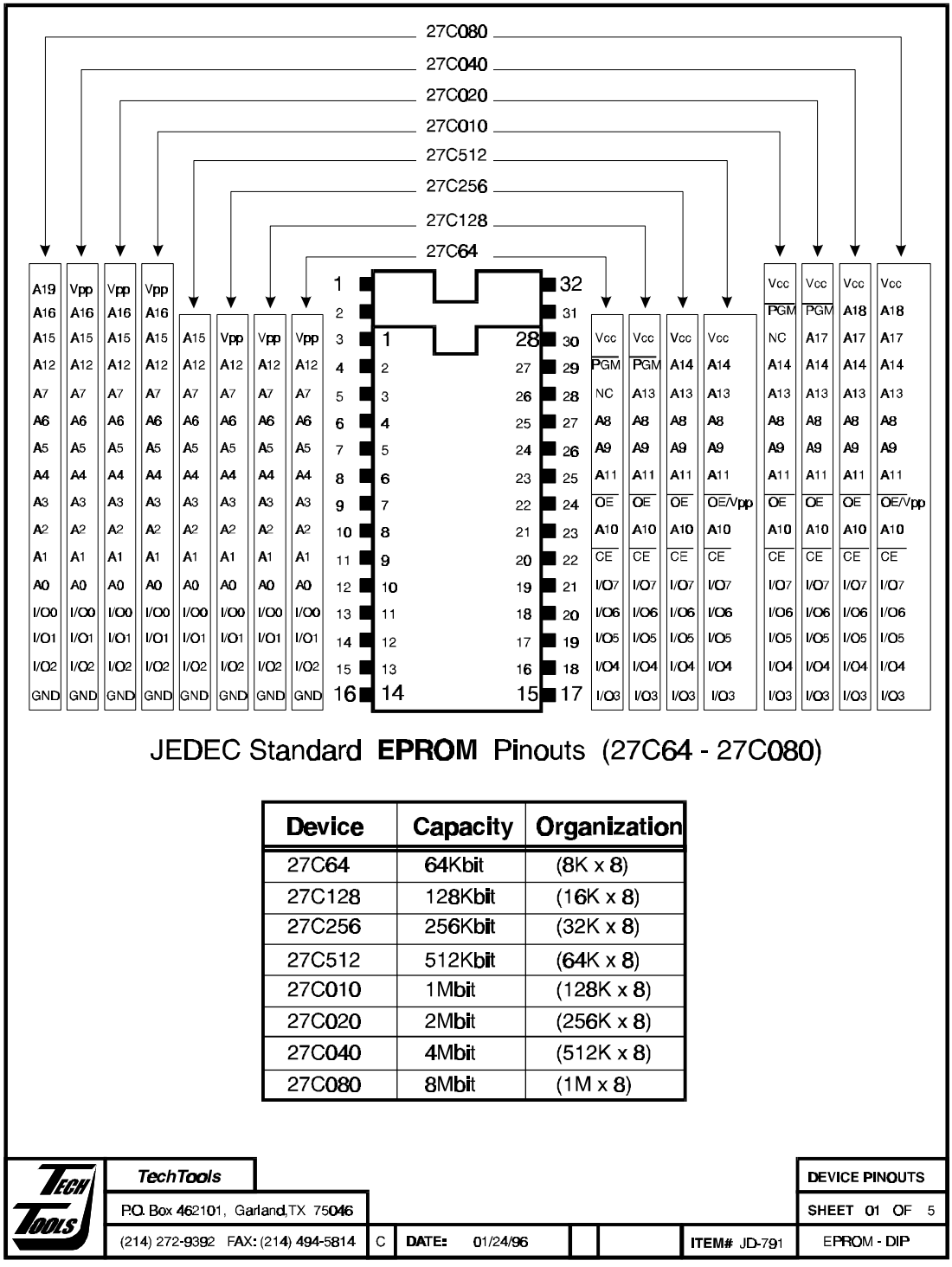
Extended Tektronix

%xx x xx .....

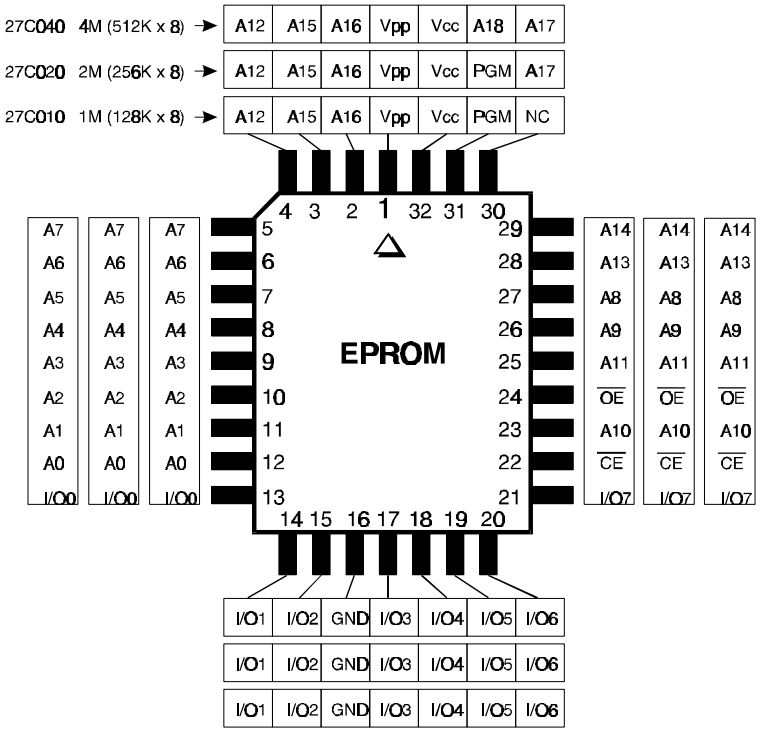
	Record Length	Record Type	Checksum	Varible Length Area		
				Address Length	Address	Data Bytes
Data Record	xx	6	xx	2-17 Hex Digits	x.....	xx.....
End Record	xx	8	xx	2-17 Hex Digits	x.....	

Appendix D - Device Pinouts

8 bit DIP EPROMs

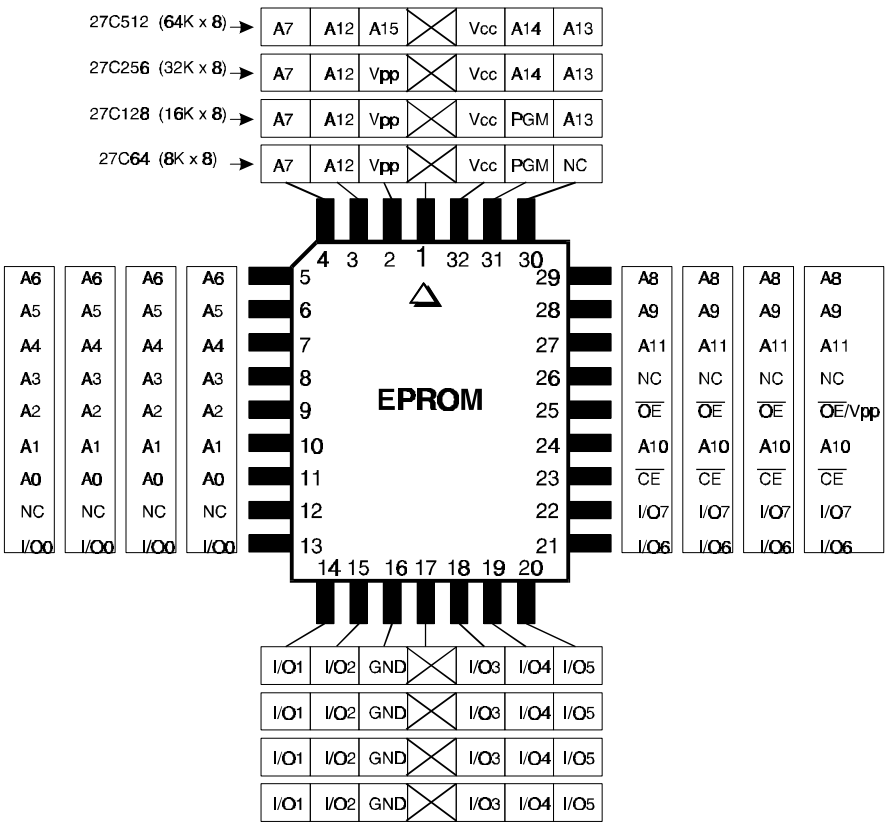


Device	Capacity	Organization
27C64	64Kbit	(8K x 8)
27C128	128Kbit	(16K x 8)
27C256	256Kbit	(32K x 8)
27C512	512Kbit	(64K x 8)
27C010	1Mbit	(128K x 8)
27C020	2Mbit	(256K x 8)
27C040	4Mbit	(512K x 8)
27C080	8Mbit	(1M x 8)



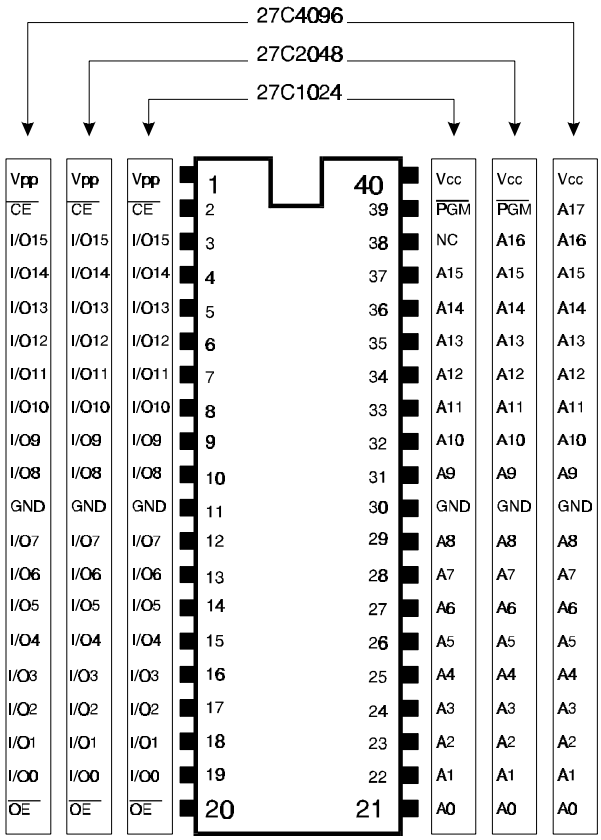
Standard PLCC **EPROM** pinouts (27C010-27C040)

TechTools					DEVICE PINOUTS
P.O. Box 462101, Garland,TX 75046					SHEET 04 OF 5
(214) 272-9392 FAX: (214) 494-5814	C	DATE: 01/24/96		ITEM# JD-794	EPROM - PLCC>=1M



Standard PLCC **EPROM** pinouts (27C64-27C512)

TECH TOOLS	*TechTools*						DEVICE PINOUTS
	P.O. Box 462101, Garland,TX 75046						SHEET 03 OF 5
	(214) 272-9392 FAX: (214) 494-5814	C	DATE: 01/24/96			ITEM# JD-793	EPROM - PLCC<1M

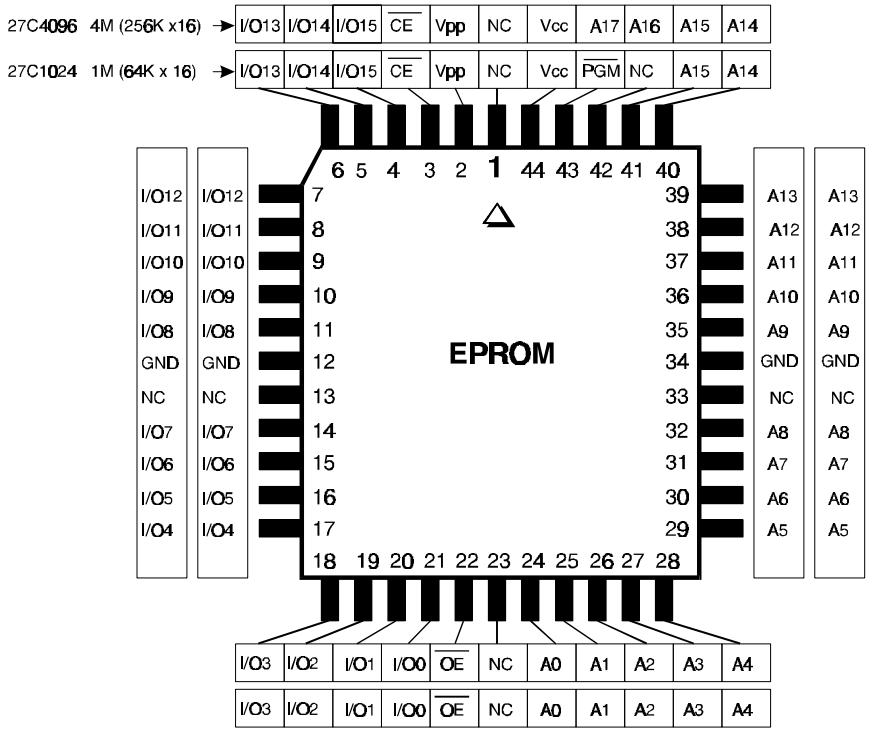


JEDEC Standard **EPROM** Pinouts (27C1024 - 27C4096)

Device	Capacity	Organization
27C1024	1Mbit	(64K x 16)
27C2048	2Mbit	(128K x 16)
27C4096	4Mbit	(256K x 16)

TechTools
P.O. Box 462101, Garland,TX 75046
(214) 272-9392 FAX: (214) 494-5814

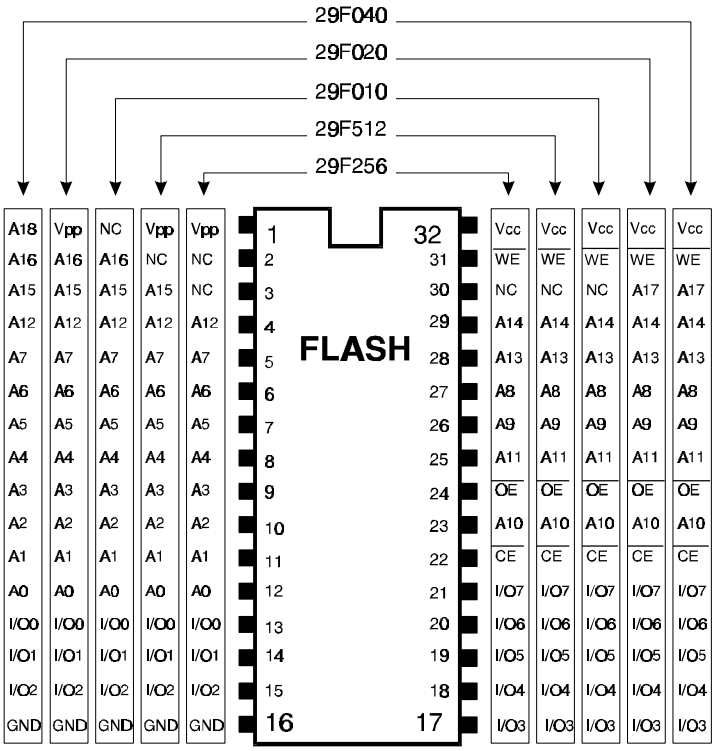
C | DATE: 01/24/96 | ITEM# JD-796 | DEVICE PINOUTS | SHEET 01 OF 4 | EPROM-DIP 16Bit



Standard PLCC **EPROM** pinouts (27C1024 - 27C4096)

64K x 16 256K x 16

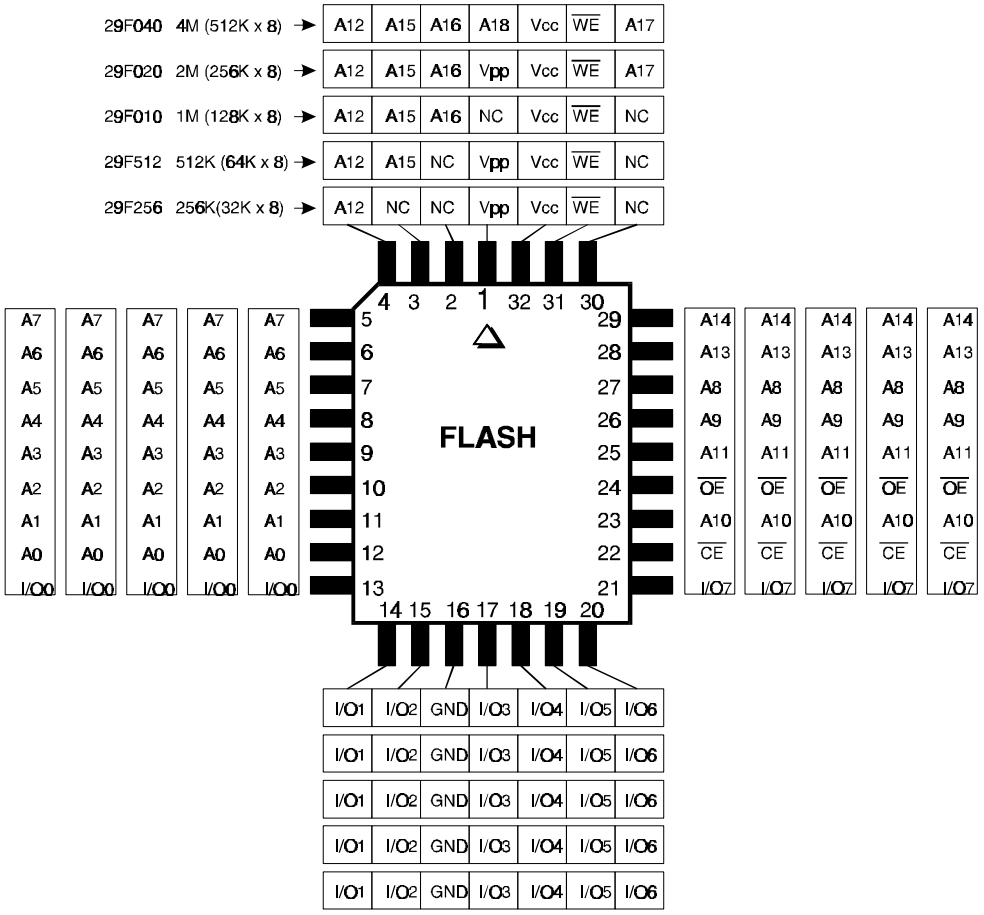
TechTools							DEVICE PINOUTS
P.O. Box 462101, Garland,TX 75046							SHEET 02 OF 4
(214) 272-9392 FAX: (214) 494-5814	C	DATE: 01/24/96				ITEM# JD-797	EPROM - PLCC 16Bit



Standard FLASH Pinouts (29F256 - 29F040)

Device	Capacity	Organization
29F256	256Kbit	(32K x 8)
29F512	512Kbit	(64K x 8)
29F010	1Mbit	(128K x 8)
29F020	2Mbit	(256K x 8)
29F040	4Mbit	(512K x 8)

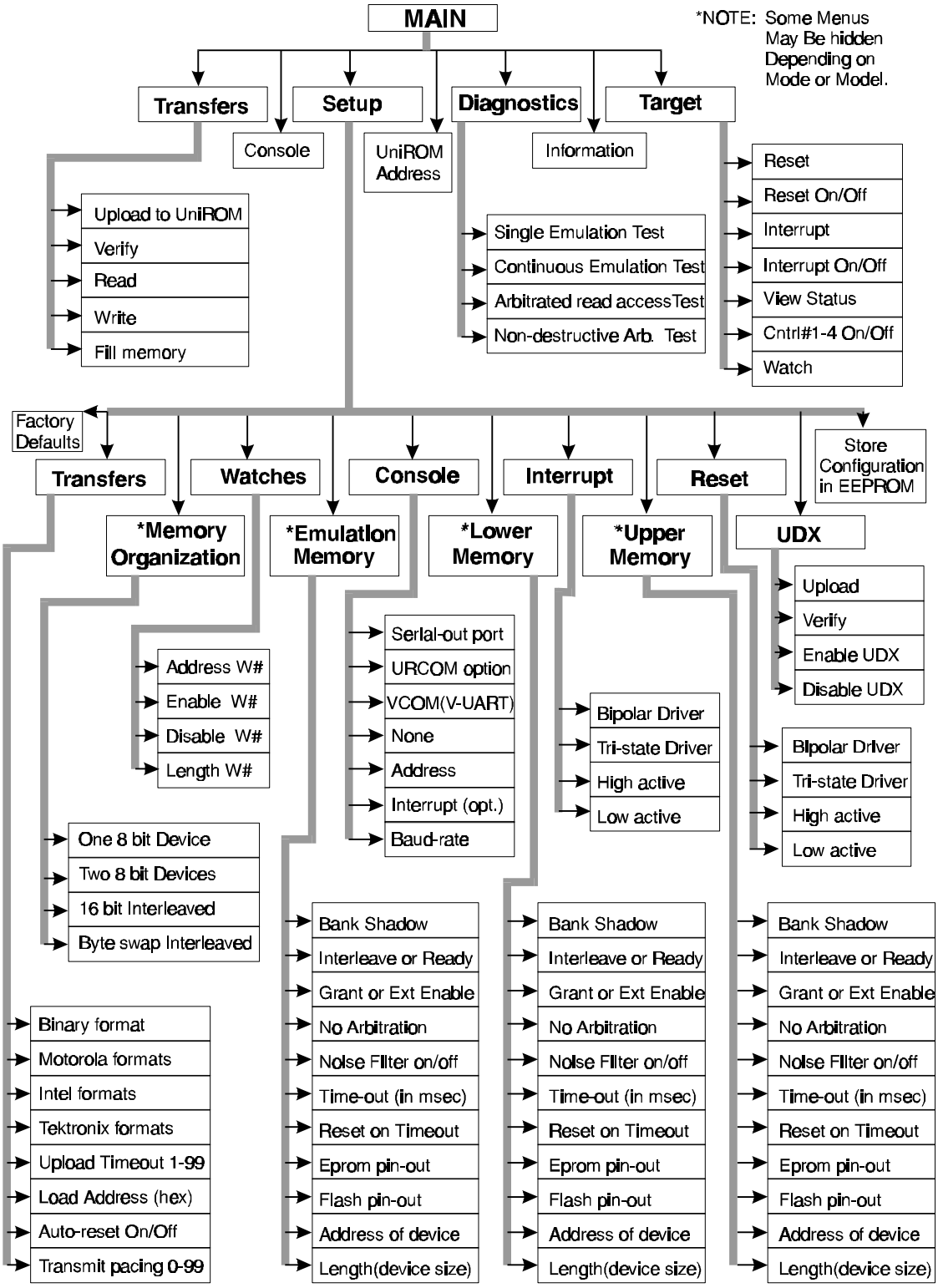
TECH TOOLS	TechTools						DEVICE PINOUTS
	P.O. Box 462101, Garland,TX 75046						SHEET 02 OF 5
	(214) 272-9392 FAX: (214) 494-5814	C	DATE: 01/24/96			ITEM# JD-792	FLASH - DIP



Standard PLCC FLASH pinouts (29F256-29F040)

TechTools				DEVICE PINOUTS
P.O. Box 462101, Garland,TX 75046				SHEET 05 OF 5
(214) 272-9392 FAX: (214) 494-5814	C	DATE: 01/24/96	ITEM# JD-795	FLASH - PLCC

Appendix E - Detailed ASCII Menu Tree



Appendix F - Technical Support

Technical Support is available 9:00am to 5:00pm CST, Monday - Friday from:

TechTools
PO Box 462101
Garland, TX 75046-2101
Voice: (972) 272-9392 FAX: (972) 494-5814 email: support@tech-tools.com