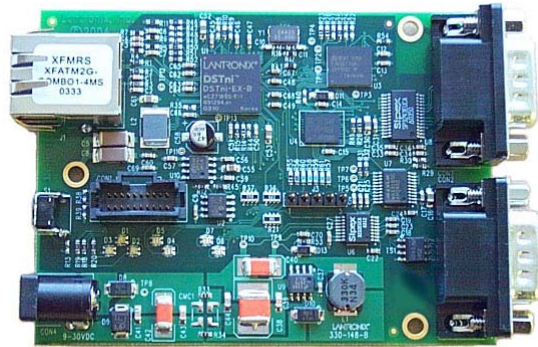


DSTni-EX Evaluation Module Manual



Revision A
Part Number 800-500-101

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DSTni-EX Evaluation Module

Part Number 800-500-101

Revision	Date	Author	Comments
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1 Introduction

1.1 Purpose of This Manual

This manual describes the installation of the DSTni-EX Evaluation Module.

1.2 Manual Notations

Additional information may be inserted at various points to help clarify or expand on a topic. This sign may also indicate a helpful hint or suggestion. A NOTES sign will appear with the associated text.

**NOTE**

The Reset switch can be disabled.

There may be some operations that require special precautions or observance to safety procedures. In such cases, you will see a CAUTION sign and detailed information.



CAUTION. Use anti-static mats and grounded wrist-bands to prevent static damage.

In special circumstances, it might be possible to damage a circuit component or other electrical device. In this case, a STOP sign will appear and the precautions listed in bold text. Please observe these warning to prevent damage to the evaluation module or other system components.



STOP. DO NOT CONNECT THIS CABLE WITH THE POWER ON.

1.3 Manual Overview

The information in this manual is organized into the following chapters:

1 Introduction	1
2 Installation	5
3 Example Project	11
4 Communication Software	13
5 Hardware Description	19
6 Appendix A, Static Electricity	21
7 Schematics	23

1.4 Support Documents

The DSTni family includes the EX and LX microprocessors. The products are supported by an extensive collection of support documents. The documents associated with the DSTni-EX are listed below. All documents can be found on the distribution CD. Design reference schematics and data sheets for certain components are also included on the CD.

DSTni-EX User Guide	GC-900-249
DSTni-OS Guide	GC-900-274
TCP/IP Stack Guide	GC-900-272
DstLoadr v2.51 User Reference	800-500-005
PDRemote Debugger Interface	800-500-006
DstMkBin Utility Program	800-500-007
Stage 2 Loader Utility	800-500-008
Stage 2 Flash Utility	800-500-009
Hello World Demo Software	800-500-010
OS Demo Software	800-500-011
Binary File Specs	800-500-012
Net Demo Software	800-500-013
DSTni-EX Bootstrap User Guide	800-500-100
DSTni-EX Evaluation Module Manual	800-500-101
DSTni-EX Evaluation Module Schematics	300-138sch_b.pdf

1.5 Evaluation Module

The evaluation module is a development platform for testing hardware and software components of a DSTni-EX design project. The evaluation module comes with a power supply and serial cable, and contains the following components:

- **DSTni EX 128Mhz 30+ MIP** Intel/AMD compatible x86 microprocessor with on-chip peripherals providing 30+ MIPS of high-speed performance. The EX Module contains a 25MHz crystal.
- 1M x 16bit Flash
- 2K x 8bit I2C Serial EEPROM
- 512K Low Power CMOS Static RAM
- JTAG Interface
- 4 Firmware Controlled LEDs. Link, Duplex, and Power LEDs
- One RS232 and one RS232/485 serial port
- Embedded Ethernet controller with Enhanced 32-byte-deep transmit FIFO, MII interface with 10/100 Mbit PHY transceiver (includes 100Base-FX)

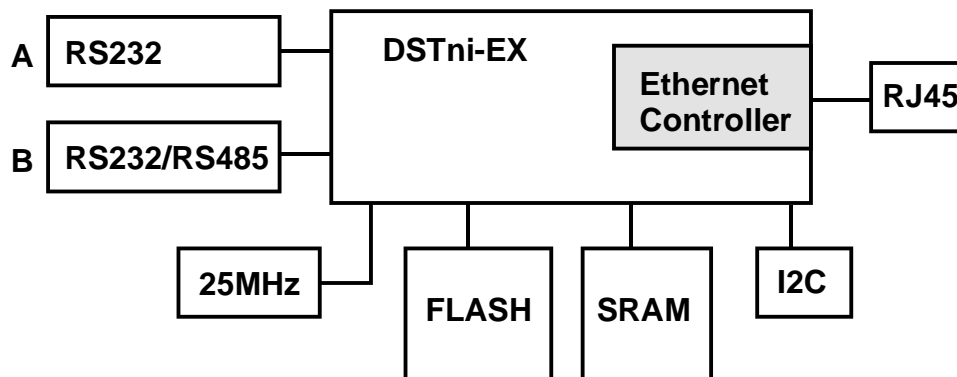


Figure 1 - DSTni-EX Module Block Diagram

2 Installation

2.1 Quick Start

This section contains the basic steps necessary to install and test the evaluation module prior to beginning a project.

2.1.1 Evaluation Module Package

The Evaluation module package contains all the components necessary to get started on a development project, including cables, software, and manuals.

Your DSTni-EX Evaluation Module kit should contain the following items:

- DSTni-EX Evaluation Module with a DSTni-EX chip
- 12VDC Power Supply (or 24VDC Power Supply)
- Serial Cable (null-modem) 9-pin female to 9-pin female

Paradigm C++ Pro Evaluation Copy

CD containing user manuals, DSTni OS, demos, etc.

- DSTni-EX Data Book

- DSTni-EX Evaluation Module Manual

- DSTni-EX Evaluation Module Schematics

*Package contents subject to change.

2.1.2 Handling Precautions



CAUTION. Use anti-static mats and grounded wrist-bands to prevent static damage.

Use caution when handling circuit boards and other electronic components. The boards are packed in anti-static bags to protect them during shipping. The use of anti-static mats is highly recommended when working with the evaluation module.

The technical difference between anti-static (static dissipative) and conductive mats is the speed at which the static electricity is removed. Faster static removal speed is not an indication of a superior product. To the contrary, removal of static electricity too quickly can actually damage circuit boards. Anti-static mats rated at 10^7 - 10^9 ohms allows effective static charge removal at a non-damaging flow rate.

2.1.3 Setup

The first step in the setup procedure is to unpack the evaluation module and check for damage, loose components, etc.

Refer to the layout drawing to locate connectors, and other major components.

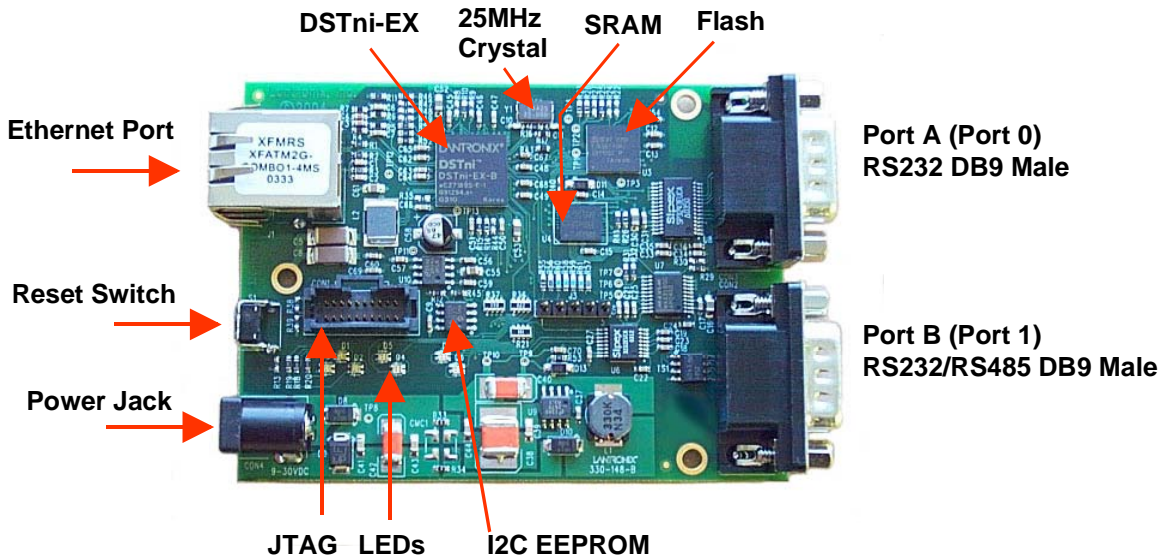


Figure 2 - Component Locator

2.1.4 Install Power Supply

Place the board on a non-conductive surface.

NOTE

Evaluation modules do not have power switches.

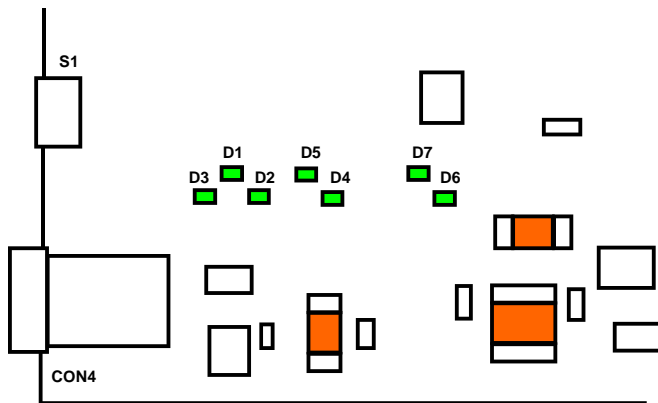
The power supply delivered with the Evaluation module can be from 9-30VDC. It is generally a 12VDC or 24VDC wall module style supply. Plug the supply into an AC outlet. Connect the power supply output cable to the power jack on the Evaluation module.

2.1.5 Power-Up Mode

When power is applied to the module, the bootstrap program starts and runs through a series of tests. A complete description of the Bootstrap operation can be found in a later section. The LED marked D3 (Power) should be Green.

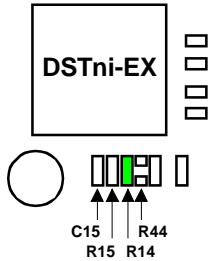
If the Flash was erased, the LED marked D2 (LED2) should be Yellow. The rest of the LEDs are OFF.

If the module contains the factory test program, D1 and D2 are Green/Yellow LEDs and should be flashing. D4-7 are Green/Red LEDs and should be flashing.



2.1.6 Reset Circuit

The Reset switch S1 is enabled at the factory by the installation of R14. Refer to Figure 2 - Component Locator on page 6 for the location of switch S1. The reset switch can be disabled by removing the jumper R14.



2.1.7 Connect to Serial Port 0

Software may be loaded via Serial Port 0 (see Table 1 - Serial Port 0/1 Pin Designations) either for immediate execution or for storage to non-volatile memory, which in this case is parallel FLASH memory.

The download cable is a generic 9-pin null-modem cable (see Table 2 - Null MODEM Cable). Connect the serial port cable to an unused port on your computer. Use a Terminal Emulation program or COM program running on your computer to establish communications with the evaluation module port 0.

Before going any further, you should understand how the Bootstrap works. This is software permanently built into the chip. Please review the DSTni-EX Bootstrap User Guide, 800-500-100.

The Communication Software chapter gives detailed instructions in using a COM program to make a connection between the evaluation board and your PC, and to download some sample test files.

Table 1 - Serial Port 0/1 Pin Designations

Pin	Port 0 Function	Port 1 Function
1	DCDA	DCDB
2	RXA	RXB (RX+485)
3	TXA	TXB (TX+485)
4	DTRA	DTRB
5	Ground	Ground
6	DSRA	DSRB
7	RTSA	RTSB (TX-485)
8	CTSA	CTSB (RX-485)
9	No Connection	No Connection

Table 2 - Null MODEM Cable

Signal Name	From Pin	To Pin	Signal Name
TD	3	2	RD
RD	2	3	TD
RTS	7	8	CTS
CTS	8	7	RTS
SG	5	5	SG
DSR	6	4	DTR
DTR	4	6	DSR

3 Example Project

3.1 Hello World

The “Hello World” sample application is a simple example of how to build an application for a DSTni-LX/EX target. The application will run on either CPU and to take advantage of the programmable clock speed in the DSTni-EX.

The application does some basic initialization and then commences sending periodic “Hello World” messages to serial port 0. If the processor is the DSTni-EX, the application will adjust chip-select wait states and then switch the CPU speed to 120 MHz. The serial port is configured for 115,200 baud, 8 data bits, no parity.

The application does not require or use an operating system. It does make use of the standard Paradigm C library for input/output functions and printf statements. For an example of an application based on DSTniOS, please see the OsDemo application located in Dstni\Os_suite\App\OsDemo. For more information about the Hello World demo software, please see the “Hello World” Demo Software manual, part number 800-500-010.

NOTE

The evaluation kit is supplied with a copy of Paradigm C++. Install it before starting the sample project.

3.1.1 Build the Application Binaries

Start Paradigm C++.

Select Project and navigate to the \DSTni\toolkit\Examples\HelloWorld\Src directory. Open the “Hello.ide” project file. This will launch the Paradigm development program and load the project. You will see 4 target application nodes:

Hello20Ram.axe 20-bit application to execute in RAM

Hello24Ram.axe 24-bit application to execute in RAM

Hello20Fla.axe 20-bit application to execute in flash

Hello24Fla.axe 24-bit application to execute in flash

Right-click on the Hello24Ram target and select “Build node” from the pop-up menu. This will compile, link and locate the application. Repeat this step for the other target nodes.

Inspect the Gen folder to verify a HEX file was generated for each node.

3.1.2 Convert Hex Files

Next, execute the batch file “makebin.bat” located in the Src directory. This will generate the following files in the Bin folder:

Hello20FlaEx.spb 20-bit for execution from flash memory – binary specific for EX

Hello20FlaLx.spb 20-bit for execution from flash memory – binary specific for LX

Hello20Ram.sdb	20-bit for execution from RAM, load and run via serial port, supports EX and LX.
Hello20Ram.spb	20-bit for execution from RAM, load and run from serial flash (LX/EX) or from parallel flash (EX only)
Hello24FlaEx.spb	24-bit for execution from flash memory – binary specific for EX
Hello24FlaLx.spb	24-bit for execution from flash memory – binary specific for LX
Hello24Ram.sdb	24-bit for execution from RAM, load and run via serial port, supports EX and LX.
Hello24Ram.spb	24-bit for execution from RAM, load and run from serial flash (LX/EX) or from parallel flash (EX only)

3.1.3 Script Files

The next step is to program the application binary into the target. Several COM scripts have been created to help do this. They are located in the HelloWorld\scripts directory with a separate directory for each CPU. The scripts are nearly identical between the two CPUs with the exception of the communication speed. The LX bootstrap uses 115,200 baud and the EX bootstrap uses 57,600 baud. The following scripts are provided for both CPUs in their respective script sub-folders:

Hello20Pf.scr	Program 20-bit binary to parallel flash for execution from flash
Hello20Sf.scr	Program 20-bit binary to serial flash for execution from RAM
Hello20Sp.scr	Download 20-bit binary to RAM for execution via serial port
Hello24Pf.scr	Program 24-bit binary to parallel flash for execution from flash
Hello24Sf.scr	Program 24-bit binary to serial flash for execution from RAM
Hello24Sp.scr	Download 24-bit binary to RAM for execution via serial port
nv_erase20.scr	Erase contents of parallel and serial flash, 20-bit mode.
nv_erase24.scr	Erase contents of parallel and serial flash, 24-bit mode.

The EX script folder provides two additional scripts:

Hello20PfRam.scr	Program 20-bit binary to parallel flash for execution from RAM
Hello24PfRam.scr	Program 20-bit binary to parallel flash for execution from RAM

To use the scripts, you will need to start the COM 7.2 program. Go to the Communication Software chapter for details.

4 Communication Software

4.1 COM 7.2

COM 7.2 is a serial communication (terminal emulator) program from TGL Micro, which allows you to transfer files between computers using many different protocols. The program is included with the software CD. Additional support or information can be obtained from:

TGL Microsystems
PO Box 422
Morristown MN 55052
E-Mail: support@tglmicro.com
WEB: www.tglmicro.com
Phone: 612-810-5803/507-685-4678
FAX: 507-685-2111

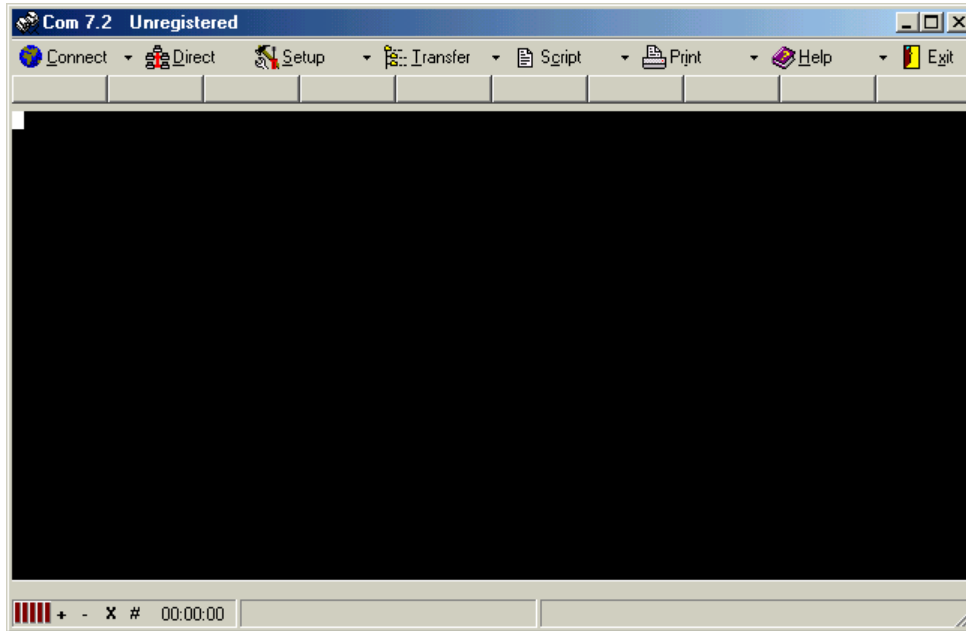
4.1.1 Communication Software Installation

Load the software CD and use the *Browse the CD* button to locate the \toolkit\Installs\COM folder. Double-click com-72.exe to install the software. The DSTni-EX CD contains several binary download and script files that can be used with COM 7.2.

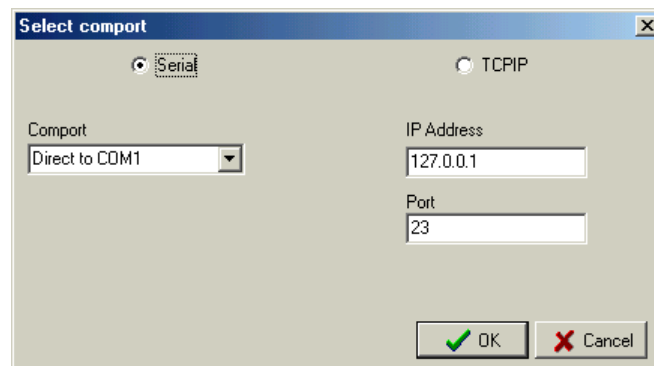
4.1.2 Running COM 7.2

To establish a communication link with the evaluation module, follow these steps.

Connect a COMM port on your host computer to serial port 0 on the evaluation module. Start COM 7.2. Go to the main screen shown below.



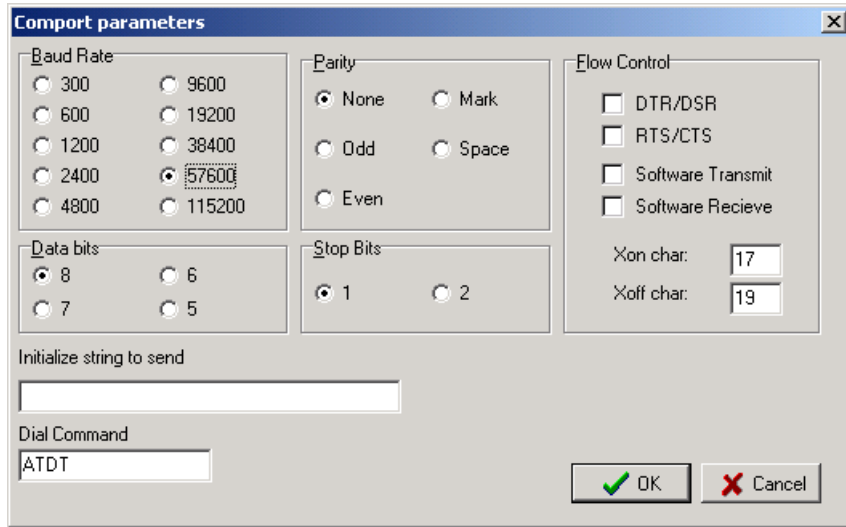
Click the Direct button to display the *Select comport* dialog box.



Click the Serial checkbox and select a COM port from the drop-down list. Click OK to display the *Comport parameters* dialog box.

NOTE

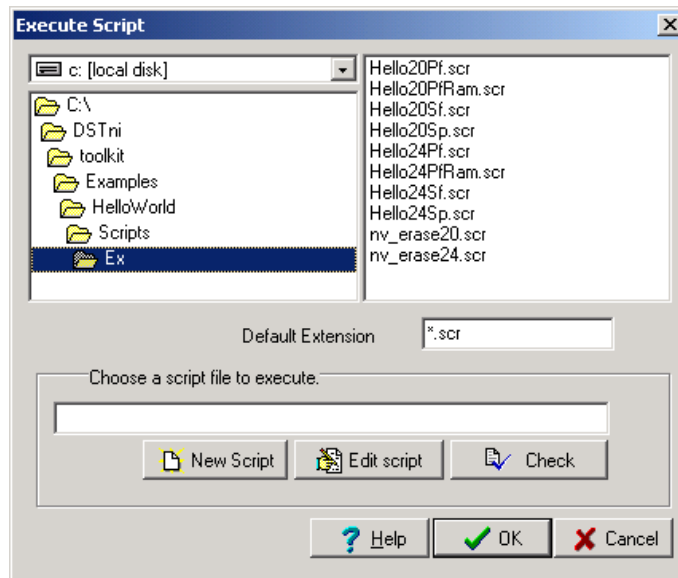
Scripts are written for COM1 support. If you use a different COM port, you will have to edit the script files. Click the Script button to display the Execute Script dialog box. Click the Edit script button and look for **all** INITPORT instructions. Change the COM setting, save and exit. Click Ok to run the script.



Make sure you select [57600 Baud Rate for the EX Module](#) and turn off the RTS/CTS option. You should also remove the Initialize string and the dial command. Click OK to return to the main menu.

A message will appear indicating you are connected to the selected comm port.

Click the Script button to display the Execute Script dialog box.



Locate the script directory at C:\DSTni\toolkit\Examples\HelloWorld\Scripts\Ex. Remember to use the Edit script button if you have a COM port setting other than COM1.

NOTE

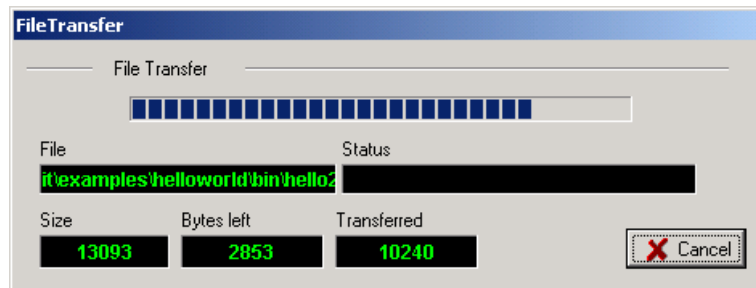
The following tests assume the Evaluation module is jumpered for 24-bit mode (Jumper R22 Removed).

4.1.3 RAM Test

The first test is to download the Hello World binary to RAM. When the download is done, the program in RAM will send “Hello World” messages to Port 0. The program in RAM is then cleared by resetting the module.

If the “Polling...” message appears, cycle the power to the module.

Select **Hello24Sp.scr** and click Ok. This script will download the file **hello24Ram.sdb** to RAM. The following message appears.



When the download is done, you should see the Hello World program sending messages to Port 0. Press reset on the evaluation module and the messages will stop.

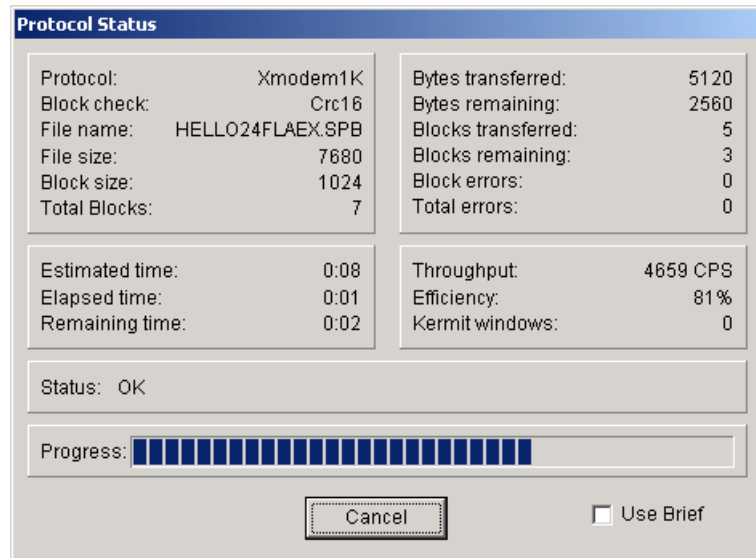
Use the down arrow next to the Connect button to select Hangup, which will disconnect the comm port. Use the Direct button to select the comm port and set the baud rate to 57600.

4.1.4 Flash Test

The next test will download the Hello World binary to Flash. When the module is reset, the program is read from Flash and executed. Each time the reset is pressed, the program is read from Flash again. The program stays in Flash until it is erased. Note the frequency of the messages is much slower than the RAM version.

Click the Script button to display the Execute Script dialog box.

Select **Hello24Pf.scr** and click Ok. This script will erase all sectors and download the file **hello24flaEx.spb** to parallel flash. The following dialog appears during the file download.



When the download is done, a message will tell you to reset the module to see the messages. Reset the module and you will see the Hello World program sending messages to Port 0. Every time you press the reset button, the program executed in Flash. The program stays in Flash until it is erased.

4.1.5 Erase Flash

To erase the Flash, use the script supplied with the Hello World example.

Click the Script button and select **nv_erase24.scr**. Click Ok to start the script. Reset the board and the program to erase parallel flash is loaded. When done, reset the board. The flash is erased and no programs are running. Exit COM 7.2.

NOTE

If the program fails to download and execute, it may be that there is a program running in FLASH that overrides the control of port 0. To overcome this problem, erase the parallel flash, then try the demo download again. Use the utility scripts located in `\DSTni\toolkit\scripts\Ex`. The scripts for the erase programs are:

ldr20_pferase.scr	Erase Parallel Flash, 20-bit mode
ldr24_pferase.scr	Erase Parallel Flash, 24-bit mode

4.1.6 Sample Scripts

Several sample scripts are included with the DSTni-EX CD. Once you install the toolkit software, the sample files are located at C:\DSTni\toolkit\scripts and a folder for EX or LX. The scripts can be modified for use in your own application. Here is a brief description of each script.

ldr20_pferase.scr	Use dstloadr.sdb to erase parallel flash (20-bit mode)
ldr24_pferase.scr	Use dstloadrx.sdb to erase parallel flash (24-bit mode)
ldr20_sferase.scr	Use dstloadr.sdb to erase serial flash (20-bit mode)
ldr24_sferase.scr	Use dstloadrx.sdb to erase serial flash (24-bit mode)
ldr24_dump.scr	Dumps a small block of memory to the terminal.
ldr24_vers.scr	Displays the version of DstLoadr.
s2test20.scr	Use to download a binary image file to serial flash (20-bit mode)
s2test24.scr	Use to download a binary image file to serial flash (24-bit mode)

5 Hardware Description

5.1 Processor

The EX Evaluation Module comes with the DSTni-EX 184-pin BGA processor by Lantronix, Inc.

5.2 Module

The Evaluation Module has the following features:

JTAG – a JTAG header for debugging.

RESET - a hard reset pushbutton to reset the unit. Optionally, this reset button can be mapped to PIO#21 for a “soft reset” function. This is accomplished via a resistor option.

PHY - The internal 10/100 PHY.

CLOCK – A 25 MHz crystal used with the PLL. Target operation is at 120MHz.

UARTS – The DSTni-EX hardware flow control and RS485 control capability used for the serial channels.

256K bytes of internal RAM, 1 wait state (@ 120 MHz).

Optional jumper pads allow enabling 20-bit address mode and disabling the watchdog.

5.3 Memory

A 2K by 8-bit EEPROM provides for long-term storage of the MAC address, serial number, setup parameters, etc. This device is tied into the processor via I2C.

A 16Mbit (1024K * 16) 70ns BGA flash provides for storage of firmware images and webpage content. At 120 MHz, this will require 9 wait states. The Ready/busy line of the flash is tied back to the DSTni-EX chip (INT 3) to provide an interrupt when a write or erase cycle is completed. Support for 1M, 2M, 4M, & 8Mbyte flash parts is provided.

8Mbit (512 * 16) 70ns RAM as additional RAM beyond what is in the DSTni-EX ASIC. At 120 MHz, there will be 9 wait states.

5.4 Serial Ports

Lightning will have 2 serial ports (channels). Each port has a DB9 male connector. Port 0 has RS232 only. Port 0 is used for initial code load, setup, and serial tunneling. Port 1 has RS232, RS422, and RS485 capabilities. RS232 (port 0 and port 1) will support the following signals: RX, TX, RTS, CTS, DTR, DSR, DCD. RS422/RS485 will support RX+, RX-, TX+, TX-. These can be bridged for 2-wire operation via firmware (it is a feature of the RS422/485 driver chip). Electrically these ports are rated in excess of 1Mbit per second operation.

5.5 Ethernet

The module has a single RJ45 Ethernet Jack providing 10/100mbit IEEE 802.3 Ethernet. It will utilize the internal DSTni-EX PHY and an RJ45 jack with integrated magnetics.

5.6 LEDs

Each of the two serial ports have two Bipolar (Red / Green) LED's associated with it. One LED will show Power on. Two bi-color LED's (Green / Amber) will provide network status indication.

5.7 Environmental

Operating temperature range: 5-50C.

Operating humidity: 0-95%, non-condensing

Storage temperature range: -40C to 66C

5.8 Certifications

C/UL, CSA, FCC-B, CE, TUV

5.9 20/24-Bit Address Support

The DSTni-EX has the ability to operate in either the standard 80x86 address mode (20-bit) having a 1Mbyte address space or in the extended address mode (24-bit) having a 16M byte address space. The mode of operation is determined by the resistor R22 (10K) at the time the DSTni-EX goes through hardware reset. R22 is removed at the factory, which enables 24-bit mode.

5.10 Watchdog Enable

The Watchdog (WDOGEN in DCR) is disabled when resistor R24 (10K) is installed. R24 is removed at the factory, which enables the watchdog timer.

5.11 Ethernet Boot

Ethernet Boot is enabled (ETHBOOT in DCR) when resistor R54 (10K) is installed. R54 is installed at the factory to enable Ethernet Boot.

6 Appendix A, Static Electricity

Static electricity is an electric charge caused by an imbalance of electrons on the surface of a material. It is most commonly caused by the contact and separation of materials. The area of contact, the speed of separation, relative humidity and other factors determine the amount of charge created in this process.

An example of this occurrence would be a person walking across the floor. Static electricity is generated as their shoe soles contact and separate from the floor surface. The amount of static electricity generated will increase due to the size of the sole surface, lower humidity and increased speed of movement.

The shock we receive upon touching another object is the transfer of the static charge or balancing of our charge to that of the object. This transfer is called Electrostatic Discharge or ESD.

Virtually all materials including water and dirt particles in the air are subject to this occurrence. The charge that is created, where it goes and how quickly is dependent on the materials characteristics and that of the materials it comes in contact with.

There are three basic types of Electrostatic Discharge (ESD).

- Direct ESD to a device (Most Prevalent)
- ESD from a device
- Field induced ESD

Direct ESD to a device – A person walking generates a static charge then touches a device causing a transfer of the electrostatic charge. A similar occurrence can happen when an electro statically charged device is brought in contact with another object.

ESD from a device – Automated part movements within a device can generate an electrostatic charge, which will discharge when the device is brought in contact with another object.

Field induced ESD – Whenever an object becomes electro statically charged there is an electrostatic field associated with that charge. If a device is placed in that field, a charge may be induced on it. If the device is momentarily grounded while within that field a transfer of charge from the device will occur.

There are two categories of damage that an ESD can create.

- Catastrophic – a complete functional breakdown of a device.
- Latent Defect – a partial degrading of the device that will down grade its productivity and longevity.

Because we cannot eliminate the generation of static in the work place, it is necessary to safely dissipate or neutralize electrostatic charges that do occur. This can be accomplished by proper grounding in conjunction with the use of Conductive or Anti-Static (dissipative) mats.

Materials are rated as Conductive if their surface resistivity is 101 to 105 ohm, Anti-Static (Static Dissipative) – 105 to 1012 ohm and Non-Conductive (Insulator) higher than 1012 ohm. The fastest neutralization of ESD being 101 ohm and the slowest is 1012 ohm.

Conductive Mats (101 to 105 ohm) have a low electrical resistance which allows ESD to flow across its surface. When attached to an earth grounding point the ESD will flow to ground and the excess charge on the mat and individual will be neutralized.

Anti-Static Mats (105 to 1012 ohm) have a higher electrical resistance than conductive mats. Like conductive mats they will allow ESD to flow across its surface but in at a slower rate. This slower neutralization of ESD prevents damage to microcircuit devices which cannot tolerate a sudden flow of static charge from the device to a grounded mat.

It is important to note that an ungrounded Conductive or Anti-Static Mat will retain an ESD and transfer the charge to the next object it comes in contact with.

It is also recommended that all devices, Conductive and Anti-Static Mats be grounded to the same common point ground. This essentially brings all components to the same electrical potential.

For most applications anti-static mats that neutralize ESD in the range of 105 to 1011 ohm will effectively handle most static situations in the work environment. Dissipation of static electric charges will occur at a rapid but controlled rate.

Wrist & Shoe Straps are designed to provide the highest level of contact with an individual and a static dissipative control device (floor mat, work surface, ground plug, etc.) They serve strictly as a channel for removing static electricity. Simply wearing a strap accomplishes nothing unless proper contact to a grounded static removal device or object is made.

7 Schematics

A PDF version of the schematics for the DSTni-EX evaluation module can be found on the software CD at \Doc\Ex.

