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# Getting Started With the MultiLINX™ Cable

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## Summary

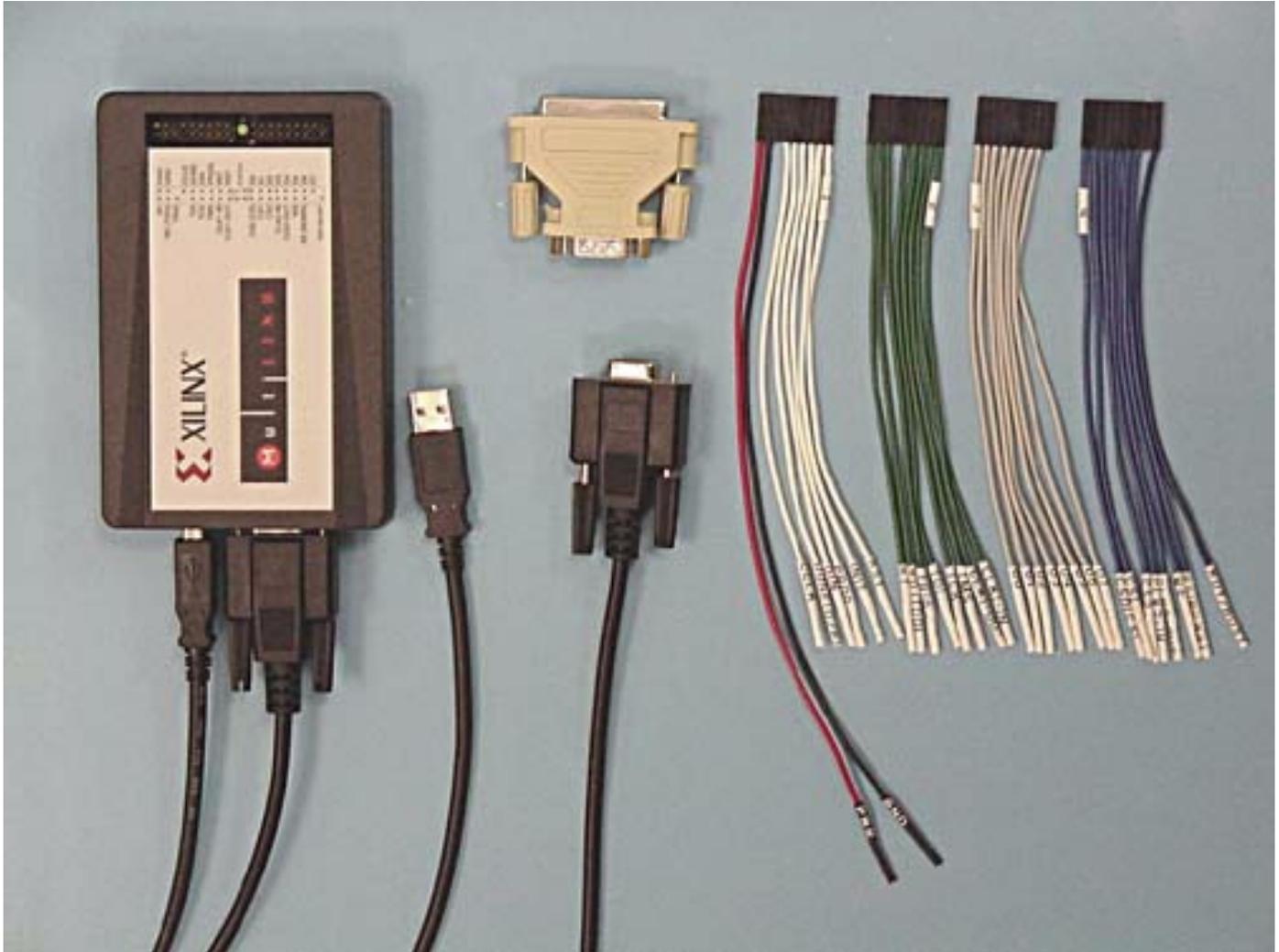
This application note provides a quick introduction to the MultiLINX cable hardware. Topics covered are a description of the cable, how to order a MultiLINX system, a list of features, what the cable may be used for, the current software support, and how to integrate cable access into a users' board. For more information on the MultiLINX cable and other hardware products from Xilinx, please refer to the *Hardware User's Guide*.

## Introduction

The MultiLINX Cable, shown in [Figure 1](#), is a new peripheral hardware product released by Xilinx in 1999. This cable is primarily used for the purpose of downloading configuration and programming data to Xilinx FPGAs and CPLDs, in a users' target system, from a host computer.

The MultiLINX cable supports a USB interface which increases communication speeds up to 12 Mbits/s, thus reducing download times by a factor of 120X compared to previous cable products. The MultiLINX Cable is also outfitted with all the appropriate flying leads for multiple configuration mode support, as well as supporting multiple readback modes such as verification, Capture, and the Virtex SelectMAP interface. This allows for quick and easy functional verification of applications that use Programmable Logic.

Additionally, the MultiLINX cables' internal hardware is upgraded via software. This allows for future expansion of cable features and software support. Upgrades are completely seamless and invisible to the user.



*Figure 1: MultiLINX Cable Pod and Attachments*

## **Obtaining the MultiLINX Cable**

Alliance and Foundation 2.1i software packages are shipped with a mail-in form to purchase the MultiLINX cable. The MultiLINX cable may also be purchased over the internet, or by credit card orders by contacting the Xilinx Customer Service Hotline.

## MultiLINX Cable Software Support

Alliance and Foundation version 2.1i is the first version of Xilinx software to support the MultiLINX cable. Additionally, a new software tool, ChipScope, is also now available for use with the MultiLINX system. Please refer to [Table 1](#) for a cross-reference of software feature support.

*Table 1: Software Support Cross-Reference*

S/W	Family	Configuration	Verification	Capture
<b>Hardware Debugger 2.1i</b>	Virtex/E	SS/SM	SM	NS
	Spartan	SS/SM	SS/SM	NS
	XC4000	SS	SS	NS
	XC3000	SS	NS	NS
<b>ChipScope</b>	Virtex/E, Spartan-II	SS/JTAG	NS	NS
	Spartan/XL	N/A	N/A	N/A
	XC4000	N/A	N/A	N/A
	XC3000	N/A	N/A	N/A
<b>JTAG Programmer 2.1i/sp3</b>	Virtex/E	JTAG	NS	NS
	Spartan*	JTAG	NS	N/A
	XC4000	JTAG	NS	N/A
	XC3000	N/A	N/A	N/A
	XC9500/XL	JTAG	JTAG	N/A
	XC18V00	JTAG	JTAG	N/A

**Notes:**

SS = Slave Serial

SM = SelectMAP

NS = Not Supported

N/A = Family is not applicable

\* Service Pack 6 required for Spartan-II

### Hardware Debugger 2.1i

The Hardware Debugger program is a standard feature for the Alliance and Foundation series software packages. The Hardware Debugger version 2.1i currently supports the use of the MultiLINX Cable for FPGA Configuration and Verification. XC4000 and Spartan Series FPGAs may be configured and verified serially through the MultiLINX Cable, refer to [Table 1](#). Virtex/E and Spartan-II series FPGAs may be configured in the serial mode, and may be configured as well as verified using the SelectMAP interface. The SelectMAP interface uses a byte-wide parallel data bus.

The high speed USB connection to the MultiLINX Cable is supported on Windows 98 and 95c platforms. The RS232 serial connection is supported on Windows 95/98/NT and Solaris/HP UNIX platforms.

### ChipScope

The ChipScope functional verification tool is currently sold separately through the Xilinx website. This program uses the MultiLINX Cable exclusively and only supports Virtex derivative FPGAs. Chipscope supports Slave Serial and JTAG configuration, and uses soft cores to capture states of internal signals. That data is read back through the use of the USER1 JTAG register.

ChipScope supports the high speed USB interface to the MultiLINX Cable on Windows 98/95c platforms and the RS232 connection on Windows 95/98/NT platforms. UNIX support is not available.

### **JTAG Programmer 2.1i**

The JTAG Programmer supports the Multilinx cable starting in 2.1i with Service Pack 3. Spartan-II JTAG support was added in Service Pack 6. The JTAG Programmer is also a standard feature of the Alliance and Foundation software packages.

The MultiLINX cable comes complete with the MultiLINX pod, a USB cable, a 9-pin com port RS232 serial cable with two 25-pin com port adapters (male and female conversion), four sets of flying leads, warranty form and connection guide.

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## **Connecting to the Host Computer**

The MultiLINX cable pod may be connected to either the RS232 serial cable or the USB cable. Only one cable should be used at a time. However, if both cables are connected the RS232 serial cable will override the USB connection.

The RS232 cable may be connected directly to the 9-pin com port of a PC. The 25-pin adapter allows for connections to the 25-pin serial com port of a PC or UNIX Workstation.

The USB cable is keyed for a "Host" connection at one end (rectangular) and a "function" connection at the other end (square). The square end connects to the MultiLINX cable pod. The rectangular end may be connected to the USB 1 or USB 2 port of a PC or to a USB Hub. Most PCs today come with USB ports included on the motherboard. If your PC does not have a USB port it may be possible to add a USB card to your system. Please consult your PC manufacturer for accessories.

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## **Connecting to a Target System**

The MultiLINX Cable has four sets of flying-lead connectors that are used to connect to a users' target system. The lead ends fit standard 25-mil header pins. Such pins are commercially available in either Wire-wrap or Solder-end style in break-away sections with 1/10 in. spacing. The target end of the leads are loose. So, board placement of the header pins is not relevant as long as they are no more than a few inches from each other. Extending the leads is possible, but may introduce noise which may interfere with the cable's operation.

The PWR and GND leads may either be connected to the target system or a separate power supply; However, GND should always be common between the target system and the MultiLINX cable for proper I/O communication. The MultiLINX cable requires a 3.3V input on the PWR lead and requires ~600 mA nominally. For more information on the operating specifications of the MultiLINX cable, consult the MultiLINX data sheet.

The I/O and configuration port connections support LVTTTL I/O standard for either 5V, 3.3V, or 2.5V specifications. Current FPGAs and CPLDs use the LVTTTL 3.3V standard. The following sub-sections provide the required lead connections for the currently supported configuration interfaces.

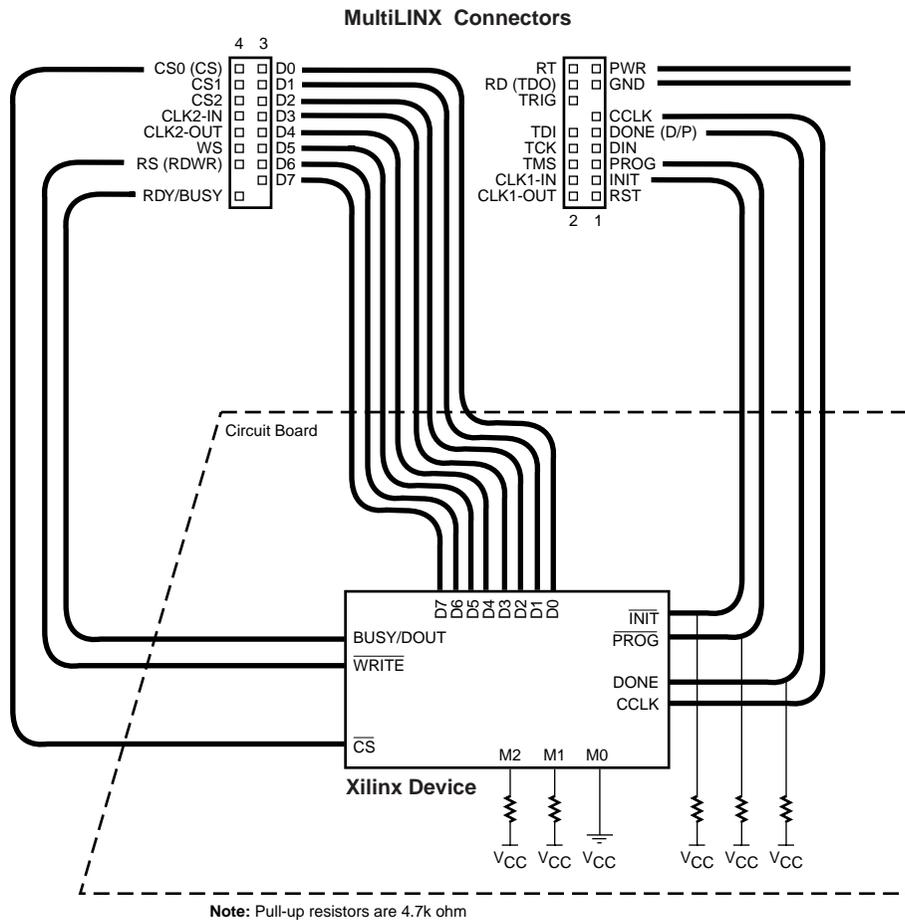
### **Slave Serial Connection**

The Slave Serial Configuration Mode for any FPGA requires the use of the following leads:

- PROG
- CCLK
- DONE
- INIT
- DIN







**Figure 4: SelectMAP Configuration and Verify**

No other connections are necessary even if Verification is to be performed. However, if Capture is to be used, shown in [Figure 5](#), then the following additional leads must also be used:

- WS
- RT
- RST

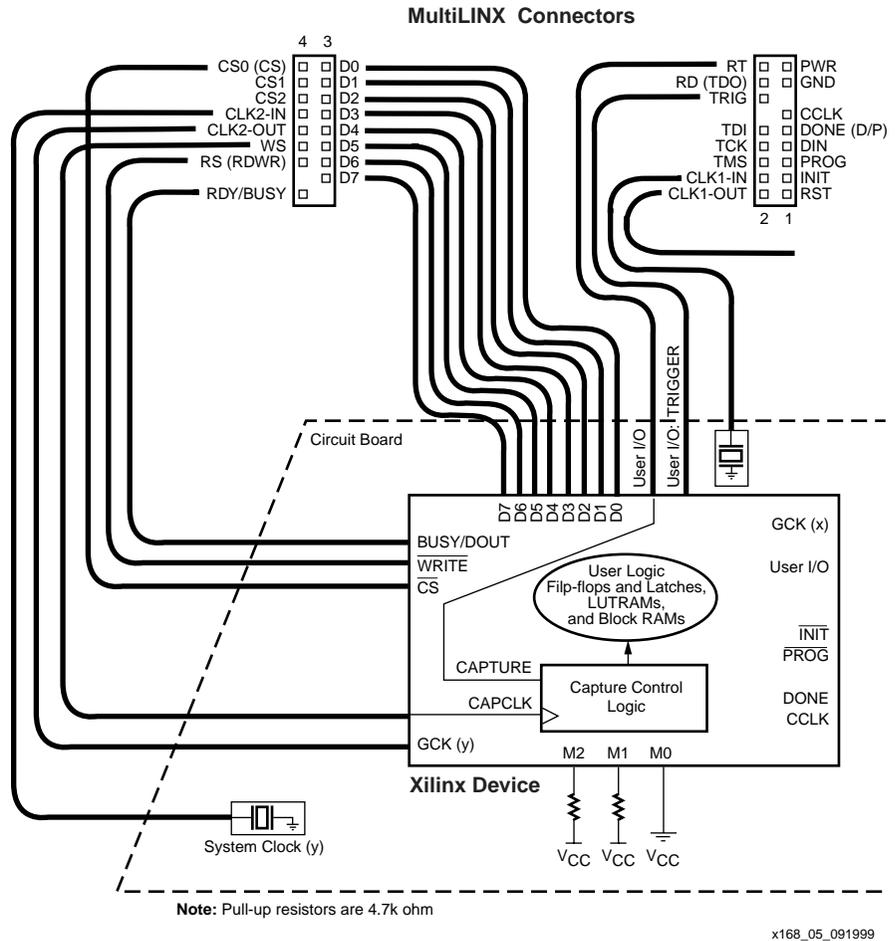


Figure 5: SelectMAP With Capture

### Boundary Scan Connection

Boundary Scan connections, shown in Figure 6, need only use the standard four JTAG leads:

- TMS
- TCK
- TDI
- TDO

However, reconfiguration requires access to the PROG pin.

- PROG

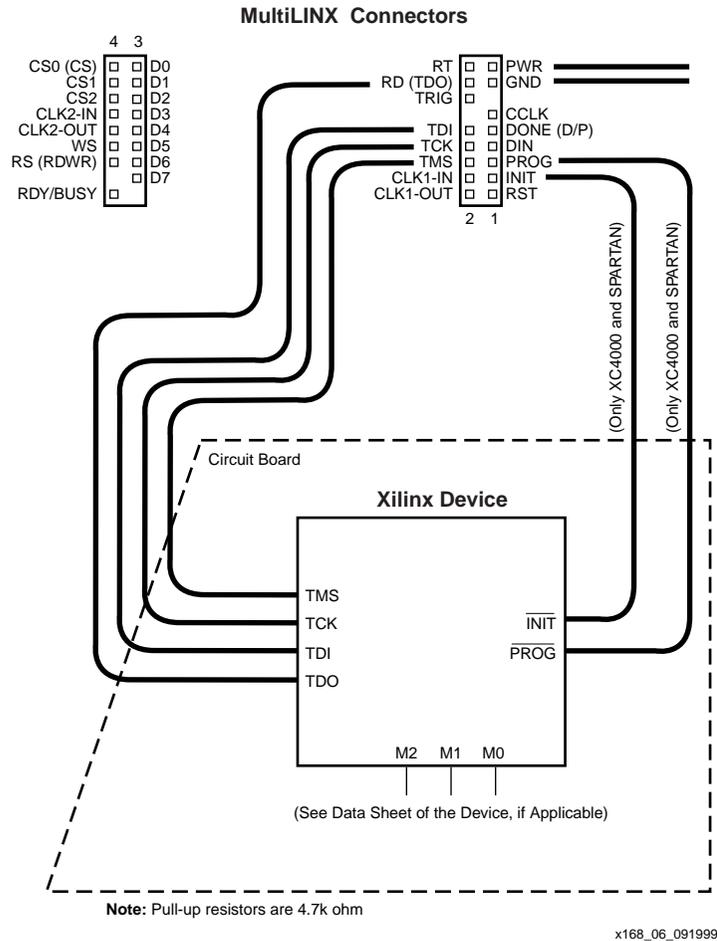


Figure 6: Boundary Scan

## Specifications for the MultiLINX Cable

### Features

Supports serial download, verification and debug for any size FPGA:

- 4000XL/XLA/XV Spartan/XL/II and Virtex/E families.
- Supports JTAG configuration for 9500 CPLD family and 4000XL, XLA, XV Virtex/E and Spartan/XL/II FPGA families
- 12 MB/s full-speed USB device
- Direct Connection: No voltage 2.5V or 3.3V adapters required
- Supports 5V, 3.3V and 2.5V voltage standards
- USB certified and compliant
- Accepts any supply voltage from 2.5V to 5V as power input (from target application or external power supply)
- Comes complete with USB cable, RS-232 cable, DB25M to DB9M adapter, and DB25F to DB9M adapter
- Configures to target hardware with four versatile flying wires
- Compatible with 5.0V, 3.3V and 2.5V target systems

The new MultiLINX™ cable takes advantage of the USB port found on newer PCs. MultiLINX delivers the ultimate in download performance: Up to 12 Mbits/second throughput. MultiLINX features an adjustable voltage interface that enables it to talk to systems and I/Os operating at 5V, 3.3V, or 2.5V.

Software support for the MultiLINX cable is provided in version 2.1i of the Alliance Series and Foundation Series software products.

The MultiLINX Cable is "CE" compliant as specified by the EMC Directives EN 55022 and EN 50082-1.

The MultiLINX Cable consists of electronics housed in a 3.33" x 5.06" x 1.03" plastic case. This assembly weighs 5.8 oz. (160 gm.) At one end of the case are the RS232 and USB connectors. Four "flying wire" sets are supplied to attach to headers on the top of the unit to the customer's Xilinx device. There is a red status LED. Either the USB or RS232 cable can be used to attach MultiLINX to the host computer (but not both). The shipping weight is 1.5 lbs. (690 gm.).

MultiLINX can communicate with the host computer via an RS232 compatible serial port. A DB9F connector is used for the RS232 port on the MultiLINX Cable. A DB9F to DB9M cable is supplied. Two DB9 to DB25 adapters (M & F) are also supplied for connecting to workstation platforms.

**Table 2: RS232 Maximum Baud Rate Support**

Computer Platform	Maximum Baud Rate
PC Compatible	57,600 baud
SPARC	38,400 baud
HP	38,400 baud

MultiLINX can also communicate with the host computer via a USB (Universal Serial Bus) compatible serial port. The supplied shielded USB cable has a Type "A" style plug to connect to the host computer port. At the other end of the USB cable is a Type "B" style plug which connects to the MultiLINX Cable's connector.

**Table 3: USB Platform Support**

Computer Platform/OS	USB Support (12 Mbits/s)
PC Compatible/Windows 98	Yes
SPARC	N/A
HP	N/A

**Note:** The MultiLINX Cable does not get its power from the USB port.

## MultiLINX Operating Characteristics

Table 4: Recommended Operating Conditions

Parameter	Operating	Non-Operating
DC Voltage	2.5V to 5.0V	N/A
Maximum Applied DC Signal Voltage per Flying Wire	-0.5V to 5.5V	N/A
Typical Current Requirements	300mA @ 5.0V, 500mA @ 3.3V, 750mA @ 2.5V	N/A
Power Req.	2 Watts Max.	N/A
Temp. Range	0°C to 55°C	-40°C to 85°C
Altitude	-100 to 15000 ft	-1000 to 50000 ft

Table 5: Reliability Characteristics

Parameter	Operating	Non-Operating
Relative Humidity	5% to 90% (non-condensing at 40°C)	5% to 95% (non-condensing at 65°C)
Vibration	0.5mm (pp), 5 - 55 Hz	1.5mm (pp), 5 - 55 Hz
Shock	5.0G, 11 ms, 1/2 sine	30G, 11 ms, 1/2 sine
Bench Drop	Three foot drop onto a solid surface with no physical damage	Three foot drop onto a solid surface with no physical damage

**Notes:**

Each of MultiLINX Cable's Flying wires is capable of driving a total capacitive load of 100 pF; Each of MultiLINX Cable's Flying wires is capable of driving a total pull-up resistance of 500 ohms; Each of MultiLINX Cable's Flying wires is capable of driving a total pull-down resistance of 5000 ohms.

## Revision History

The following table shows the revision history for this document.

Date	Version	Revision
10/6/99	1.0	Initial Xilinx release.
2/8/00	1.1	Updated format and Figure 1.
4/20/00	1.2	Updated software and device support.