XILINX®

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, a list of features, what the cable may be used for, 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, refer to the **Hardware User's Guide**.

Introduction

The MultiLINX cable, shown in Figure 1, is a peripheral hardware product used for downloading configuration and programming data to Xilinx FPGAs, CPLDs, and Xilinx configuration storage devices in a users' target system, from a host computer.

The MultiLINX cable supports a USB interface and is outfitted with all the appropriate flying leads for multiple configuration mode support, as well as supporting multiple readback modes such as verification. 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.

Specifications for the MultiLINX Cable

Features

Supports serial download and verification for any size FPGA:

- 4000XL/XLA/XV, Spartan™/XL/II/IIE, and Virtex™/E/II families.
- Supports JTAG configuration for 9500/XL/XV, CoolRunner™/II CPLD family and 4000XL/ XLA/XV, Virtex/E/II, and Spartan/XL/II/IIE FPGA families
- Direct Connection: No voltage 2.5V or 3.3V adapters required
- Supports 5.0V and 3.3V voltage standards
- USB certified and compliant
- Accepts any supply voltage from 2.5V to 5.0V 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

MultiLINX features an adjustable voltage interface that enables it to talk to systems and I/Os operating at 5.0V and 3.3V.

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 1: **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 2: **USB Platform Support**

Computer Platform/OS	USB Support
PC Compatible/Windows 98, Windows Me, XP, and 2000	Yes
SPARC	N/A
HP	N/A

Notes:
1. The MultiLINX cable does <u>not</u> get its power from the USB port.
2. Alliance Series™ and Foundation™ 4.2i SP3 support Windows 98.
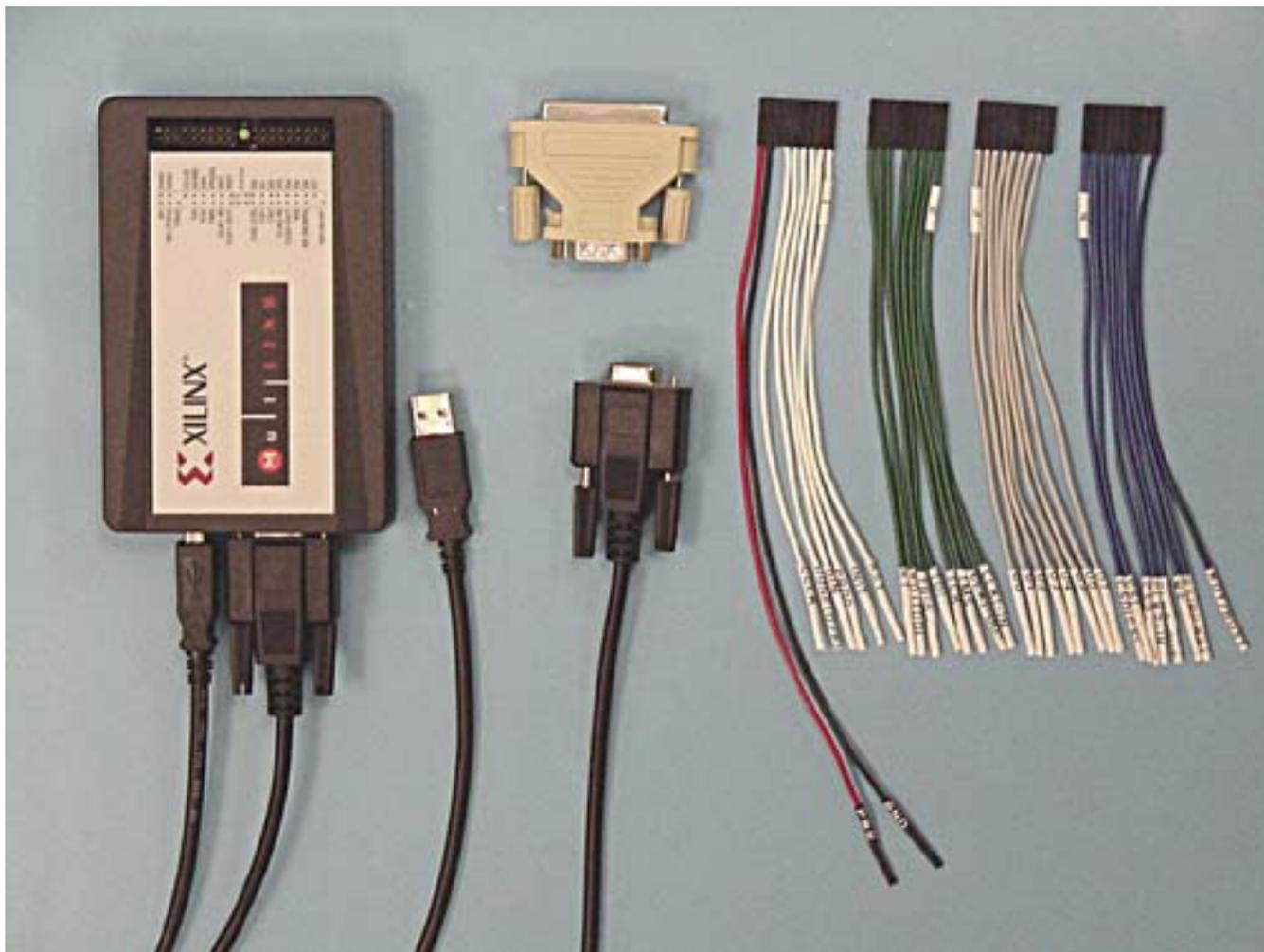3. Alliance Series and Foundation 5.1i support Windows Me, XP, and 2000.

Figure 1: **MultiLINX Cable Pod and Attachments**

MultiLINX Cable Software Support

Alliance Series and Foundation version 4.2i or later supports the MultiLINX cable. Additionally, ChipScope™ is also available for use with the MultiLINX system. Refer to Table 3 for a cross-reference of software feature support.

Table 3: **Software Support Cross-Reference**

S/W	Family	Configuration	Verification
ChipScope[1]	Virtex/E/II, Virtex-II Pro™ Spartan-II/E	JTAG	NS
ChipScope Pro	Virtex/E/II, Virtex-II Pro Spartan-II/E	NS	NS

Table 3: **Software Support Cross-Reference** *(Continued)*

S/W	Family	Configuration	Verification
iMPACT	Virtex/E/II Virtex-II Pro	JTAG	NS
	Spartan/XL/II/IIE	JTAG	NS
	XC4000/XL/XV/XLA	JTAG	NS
	XC9500/XL/XV	JTAG	JTAG
	XC18V00	JTAG	JTAG
	CoolRunner/II	JTAG	JTAG

Notes:
1.   4.2i ChipScope supports MultiLINX.
2.   NS = Not Supported.

ChipScope

The ChipScope functional verification tool is currently sold separately through the Xilinx website. This program uses the MultiLINX cable and only supports Virtex derivative FPGAs. ChipScope supports 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.

Refer to the *ChipScope Software and ILA Core User Manual* for platform support.

ChipScope Pro

This functional verification tool does not support MultiLINX.

iMPACT Software

The iMPACT Software supports the Multilinx cable in Foundation, Foundation ISE, and Alliance packages 4.2i and later. The iMPACT program is used to configure, program, and verify Xilinx FPGAs, CPLDs, and configuration storage devices. Refer to Table 3 for supported devices.

Connecting to the Host Computer

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.

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. MultiLINX has a standard USB 1.x connector.

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 LVTTL I/O standard for either 5.0V or 3.3V specifications. 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

These connections are shown in Figure 2. For more information on the Slave Serial Configuration Mode please consult the data sheet for the target FPGAs' family type.
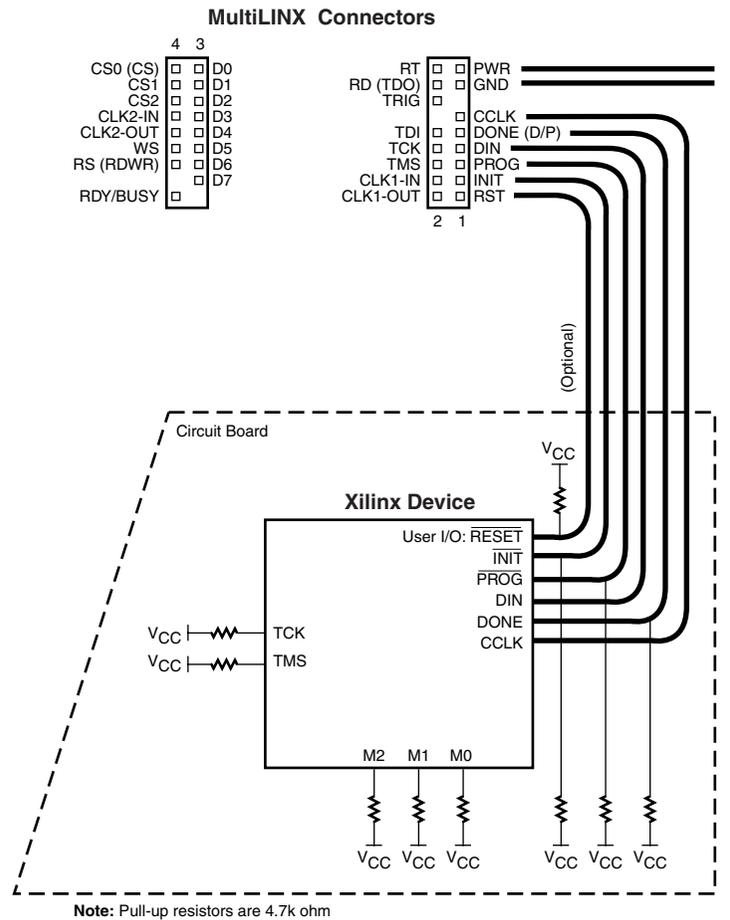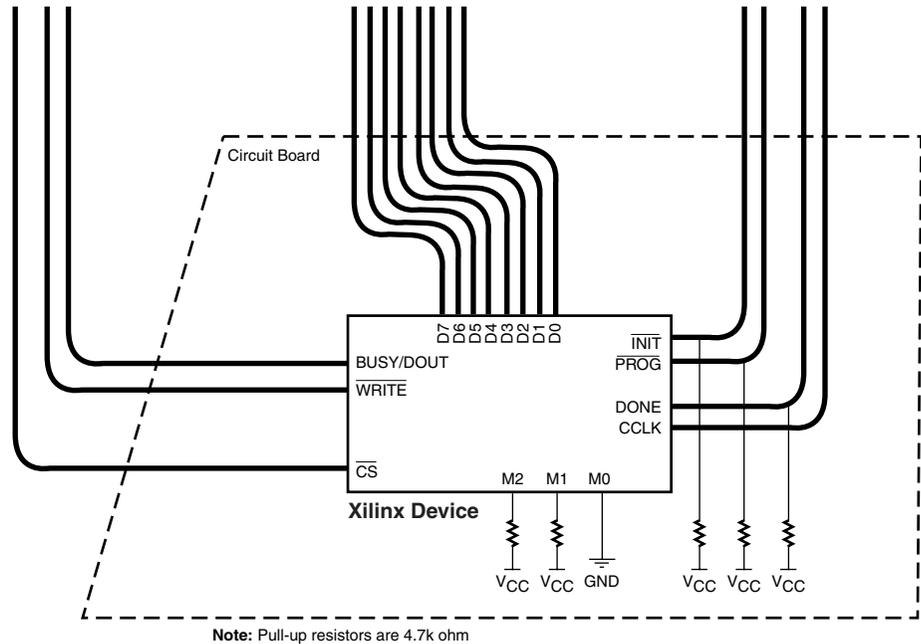

Figure 2: **Serial Configuration**

SelectMAP Connection

The SelectMAP interface to Virtex FPGAs, shown in Figure 3, require the use of the following leads:

- PROG
- CCLK
- DONE
- INIT
- D0 - D7
- RS (RDWR)

Note: Pull-up resistors are 4.7k ohm

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Figure 3: **SelectMAP Configuration and Verify**

Boundary Scan Connection

Boundary Scan connections, shown in Figure 4, need only use the standard four JTAG leads:

- TMS
- TCK
- TDI
- TDO

However, reconfiguration requires access to the PROG pin only for XC4000 Series and Spartan/XL FPGA devices.
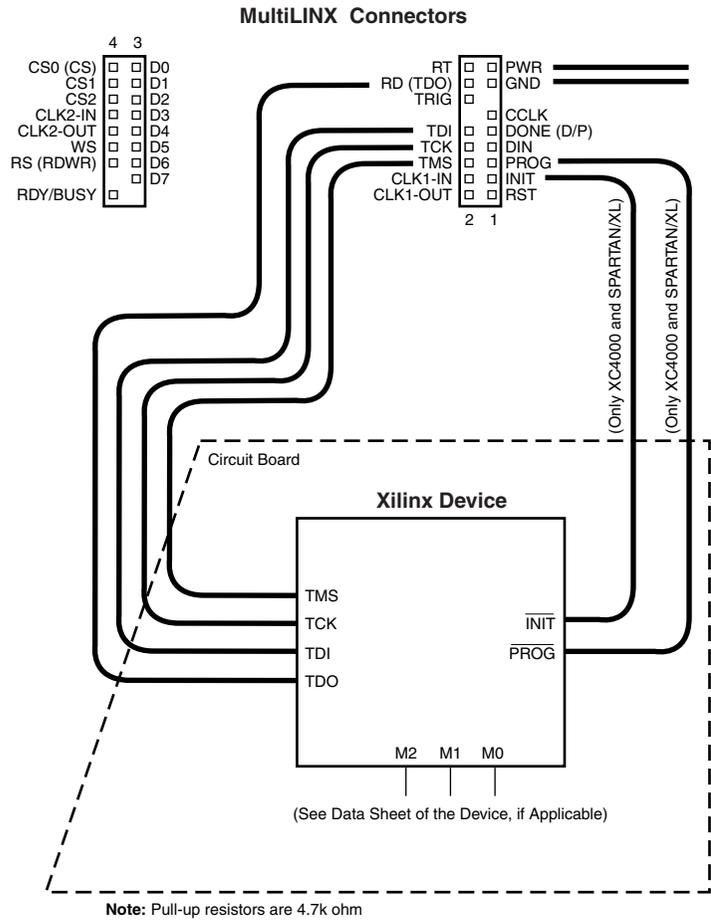
PROG

MultiLINX Connectors

Note: Pull-up resistors are 4.7k ohm

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Figure 4: **Boundary Scan**

MultiLINX Operating Characteristics

Table 4: **Recommended Operating Conditions**

Parameter	Operating	Non-Operating
DC Voltage	3.3V to 5.0V	N/A
Maximum Applied DC Signal Voltage per Flying Wire	−0.5V to 5.5V	N/A
Typical Current Requirements	300 mA @ 5.0V, 500 mA @ 3.3V, 750 mA @ 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 ft to 15,000 ft	−1,000 ft to 50,000 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	0.5 mm (pp), 5 to 55 Hz	1.5 mm (pp), 5 to 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:

1. Each of the MultiLINX cable's flying wires is capable of driving a total capacitive load of 100 pF; each of the MultiLINX cable's flying wires is capable of driving a total pull-up resistance of 500Ω; each of the MultiLINX cable's flying wires is capable of driving a total pull-down resistance of 5000Ω.

Revision History

The following table shows the revision history for this document.

Date	Version	Revision
10/06/99	1.0	Initial Xilinx release.
02/08/00	1.1	Updated format and Figure 1.
4/20/00	1.2	Updated software and device support.
11/26/02	2.0	Complete revision of document.