Arm® DS-5

Version 5.29

Arm DSTREAM User Guide

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Arm® DS-5

Arm® DSTREAM User Guide

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Release Information

Document History

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A	May 2010	Non-Confidential	First release
B	November 2010	Non-Confidential	Second release
C	30 April 2011	Non-Confidential	DSTREAM and RVI v4.2.1 Release
D	29 July 2011	Non-Confidential	Update 1 for DSTREAM and RVI v4.2.1
E	30 September 2011	Non-Confidential	DSTREAM and RVI v4.4 Release
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Product Status

The information in this document is Final, that is for a developed product.

Web Address

http://www.arm.com

Conformance Notices

This section contains conformance notices.

Federal Communications Commission Notice

This device is test equipment and consequently is exempt from part 15 of the FCC Rules under section 15.103 (c).

Class A

Important: This is a Class A device. In residential areas, this device may cause radio interference. The user should take the necessary precautions, if appropriate.

CE Declaration of Conformity

The system should be powered down when not in use.

It is recommended that ESD precautions be taken when handling DSTREAM equipment.

The DSTREAM modules generate, use, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

•   Ensure attached cables do not lie across the target board.
•   Increase the distance between the equipment and the receiver.
•   Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
•   Consult Arm® Support for help.

——————— **Note** ———————

It is recommended that wherever possible shielded interface cables be used.

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Preface

This preface introduces the *Arm® DS-5 Arm DSTREAM User Guide*.

It contains the following:

About this book

Arm® DSTREAM User Guide describes the DSTREAM debug and trace unit, and the hardware that enables you to use it. This document is written for those using DSTREAM with DS-5 Debugger, and is available as a PDF.

Using this book

This book is organized into the following chapters:

Chapter 1 Introduction to Arm DSTREAM
> Describes Arm DSTREAM™, and describes the software components.

Chapter 2 System requirements for using Arm DSTREAM
> Describes the system requirements for Arm DSTREAM and how to connect the DSTREAM unit to your host computer and target system.

Glossary

The Arm® Glossary is a list of terms used in Arm documentation, together with definitions for those terms. The Arm Glossary does not contain terms that are industry standard unless the Arm meaning differs from the generally accepted meaning.

See the *Arm® Glossary* for more information.

Typographic conventions

italic
> Introduces special terminology, denotes cross-references, and citations.

bold
> Highlights interface elements, such as menu names. Denotes signal names. Also used for terms in descriptive lists, where appropriate.

`monospace`
> Denotes text that you can enter at the keyboard, such as commands, file and program names, and source code.

<u>`mono`</u>`space`
> Denotes a permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.

`monospace italic`
> Denotes arguments to monospace text where the argument is to be replaced by a specific value.

`monospace bold`
> Denotes language keywords when used outside example code.

`<and>`
> Encloses replaceable terms for assembler syntax where they appear in code or code fragments. For example:
>
> ```
> MRC p15, 0, <Rd>, <CRn>, <CRm>, <Opcode_2>
> ```

SMALL CAPITALS
> Used in body text for a few terms that have specific technical meanings, that are defined in the *Arm® Glossary*. For example, IMPLEMENTATION DEFINED, IMPLEMENTATION SPECIFIC, UNKNOWN, and UNPREDICTABLE.

Feedback

Feedback on this product

If you have any comments or suggestions about this product, contact your supplier and give:
- The product name.
- The product revision or version.
- An explanation with as much information as you can provide. Include symptoms and diagnostic procedures if appropriate.

Feedback on content

If you have comments on content then send an e-mail to *errata@arm.com*. Give:

- The title *Arm DS-5 Arm DSTREAM User Guide*.
- The number 100955_0529_00_en.
- If applicable, the page number(s) to which your comments refer.
- A concise explanation of your comments.

Arm also welcomes general suggestions for additions and improvements.

─────── **Note** ───────

Arm tests the PDF only in Adobe Acrobat and Acrobat Reader, and cannot guarantee the quality of the represented document when used with any other PDF reader.

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Other information

- *Arm® Developer*.
- *Arm® Information Center*.
- *Arm® Technical Support Knowledge Articles*.
- *Technical Support*.
- *Arm® Glossary*.

Chapter 1
Introduction to Arm DSTREAM

Describes Arm DSTREAM™, and describes the software components.

It contains the following sections:

1.1 About DSTREAM

DSTREAM is a debug and trace hardware unit that enables powerful software debug and optimization on any Arm processor-based hardware target. It connects to the target using hardware interfaces such as JTAG or *Serial Wire Debug* (SWD).

DSTREAM also enables the collection of trace from the device for non-intrusive debug and code optimization.

——————— **Note** ———————

Some debuggers are unable to capture trace from the external trace port of a *System-on-Chip* (SoC) device. See the documentation that accompanies your debugger for details of the trace capabilities of your debugger.

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Related concepts

1.2 DSTREAM product contents on page 1-11
1.3 DSTREAM availability and compatibility on page 1-12
1.4 The DSTREAM unit on page 1-13
1.5 The DSTREAM probe on page 1-16
1.7 Updating the DSTREAM firmware on page 1-19
1.8 The DSTREAM host software on page 1-20

1.2 DSTREAM product contents

The DSTREAM product includes everything you need to connect your workstation to your Arm architecture-based target.

The DSTREAM product consists of:
- A DSTREAM unit.
- A DSTREAM probe.
- Mains cables and an external power adapter for the DSTREAM unit.
- An Ethernet cable.
- A USB cable.
- Probe cables:
  — a 100-way probe cable
  — an Arm/TI JTAG 14-way ribbon cable
  — an Arm JTAG 20-way ribbon cable
  — a Mictor 38 cable
  — a MIPI 34-way ribbon cable
  — a CoreSight 10-way ribbon cable
  — a CoreSight 20-way ribbon cable.
- Documentation, including a Quick Start Guide.

Related concepts

1.1 About DSTREAM on page 1-10

1.3 DSTREAM availability and compatibility on page 1-12

1.4 The DSTREAM unit on page 1-13

1.5 The DSTREAM probe on page 1-16

1.7 Updating the DSTREAM firmware on page 1-19

1.8 The DSTREAM host software on page 1-20

1.3　DSTREAM availability and compatibility

DSTREAM is available from Arm and its resellers.

Contact Arm directly regarding OEM licenses.

See the documentation for your Arm debug tools to determine the compatibility with DSTREAM.

DSTREAM provides:
- The ability to access the target.
- Tools to configure your debugger so that it can connect to the target through DSTREAM. Your debugger provides the user interface items, such as register windows and disassemblers, that make it possible to debug your application.

Related concepts

1.1 About DSTREAM on page 1-10

1.4 The DSTREAM unit

The DSTREAM unit provides the hardware interface to enable a software debugger to control and trace multiple devices on a single target.

The unit has ports at the rear for connecting to the host computer and to a power source. These ports are shown in the following figure.
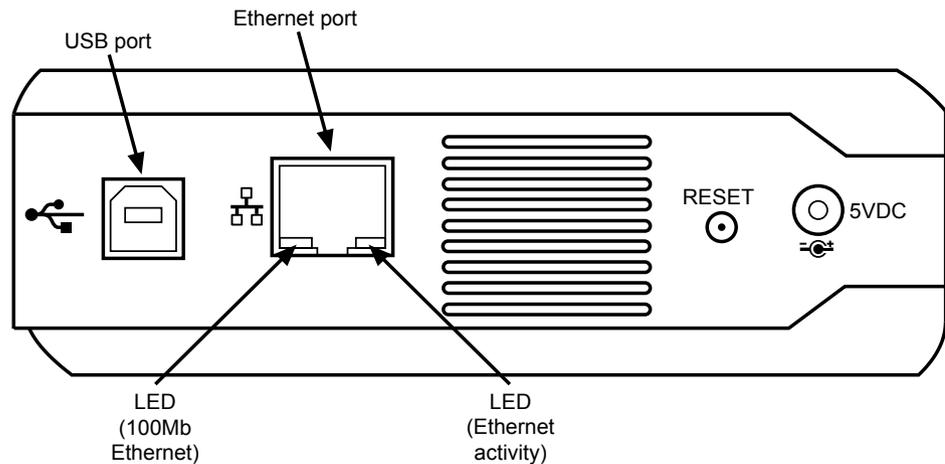
Figure 1-1 Rear of DSTREAM unit

The LEDs at the bottom of the Ethernet port display information about Ethernet speed and activity:

- The green LED shows the Ethernet speed. When Off, it indicates a speed of 10Mbps, and when On indicates a speed of 100Mbps.
- The yellow LED indicates that activity is taking place.

The RESET button resets the DSTREAM unit when required:

- Press and hold the RESET button until the STATUS LED starts to flash green rapidly. If you release the RESET button at this point, a normal reboot occurs.
- If you continue to hold the RESET button for 10 seconds more, the STATUS LED flashes red rapidly. When you release the RESET button after this point, DSTREAM reboots and enters a recovery mode, which enables you to update firmware.

The ports at the front of the unit are shown in the following figure.
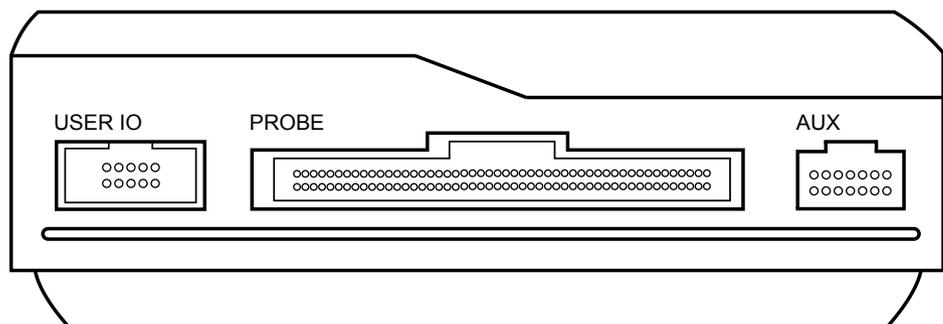
Figure 1-2 Front of DSTREAM unit

The AUX port is included for future enhancement of the product.

Ethernet and USB cables are supplied to connect the DSTREAM unit to your host computer. Probe cables are supplied to connect the DSTREAM unit to the target hardware.

The following figure shows the location and name of each of the indicator LEDs.
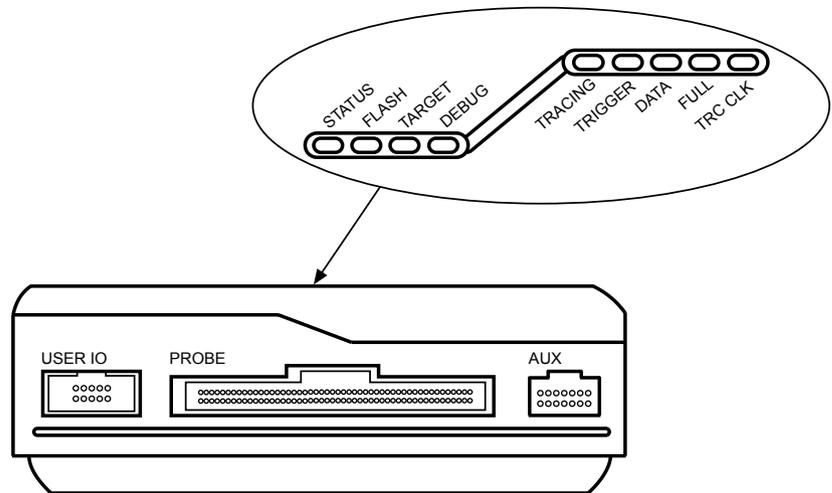
Figure 1-3 Indicator LEDs

When you power-up the DSTREAM unit, the DSTREAM logo on the top of the unit illuminates and the STATUS LED begins to flash. The STATUS LED remains illuminated to show that DSTREAM is in its ready state.

The DSTREAM logo flashes for five seconds when you use the **Identify** tool.

The LEDs representing the DSTREAM debug feature have the following functions:

STATUS

The STATUS LED illuminates as continuous red if a critical error is detected. You must reboot DSTREAM before you can continue using it. To do this, press and hold the RESET button for approximately three seconds, until the STATUS LED turns off.

FLASH

The FLASH LED illuminates green to denote that the unit is accessing its internal flash storage.

TARGET

The TARGET LED illuminates when a target VTref is detected through the probe.

DEBUG

The DEBUG LED illuminates green when debug data transfer is taking place.

The LEDs representing the DSTREAM trace feature have the following functions:

TRACING

The TRACING LED indicates that tracing is in progress.

TRIGGER

The TRIGGER LED indicates that a trigger is detected.

DATA

The DATA LED indicates that there is valid data in the data buffer.

FULL

The FULL LED illuminates when a sufficient amount of trace data has been captured to fill the defined buffer size. The buffer then wraps, and continues to capture trace data, overwriting the original trace data captured.

TRC CLK

If green, the TRC CLK LED indicates that a valid trace clock is detected. If red, the TRC CLK LED indicates that there is a problem with the trace clock.

If the probe TRC CLK LED is green and the DSTREAM unit TRC CLK LED is red then the target is outputting a trace clock but the DSTREAM unit is unable to lock on to it. Possible causes for this are that the clock frequency is too high or that the clock frequency is varying too much.

——————— **Note** ———————

The DSTREAM unit contains an internal cooling fan that operates to control the internal temperature when necessary. Do not obscure the ventilation panels on the front and back of the DSTREAM unit.

———————————

Related concepts

Related tasks

1.5 The DSTREAM probe

The DSTREAM probe unit allows DSTREAM to interface with commonly-used debug and trace interfaces provided on a target.

The probe connects to the main DSTREAM unit by a 100mm high-density ribbon cable. An optional 2m cable is available. When connecting to the target, select the appropriate connectors on the probe to match the connectors on the target. Cables for each of these connectors are supplied with DSTREAM. At any one time, use only the cables that are to be connected to the probe unit for the current debug and trace session.

1.5.1 DSTREAM probe connectors

Various connectors are available on the DSTREAM probe to enable you to connect to the corresponding connector on your target hardware.

The available connectors for the DSTREAM probe are:

Arm JTAG 14
> This is an older Arm connector standard which is now rarely used.

TI JTAG 14
> This is a Texas Instruments connector standard used by most TI-based target boards.

Arm JTAG 20
> This is the most commonly-used debug connector standard for Arm architecture-based target boards.

MICTOR 38
> This is the most commonly used trace connector standard for Arm architecture-based target boards. It can also incorporate all the debug signals if they use the same voltage domain.

MIPI 34
> This is a MIPI connector standard that supports debug and trace signals. It has two **VTref** signals, allowing debug and trace signals to use different voltage domains.

CORESIGHT 10/20
> These are high-density connectors that support the 10-way and 20-way CoreSight standards in addition to a subset of the MIPI debug connection standards.

The following figure shows the layout of the DSTREAM probe connectors:
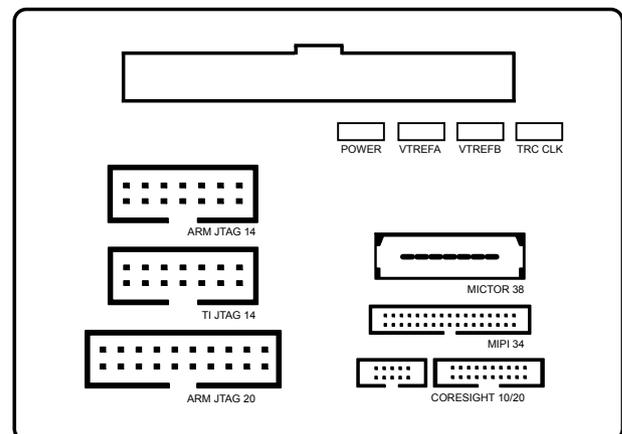
Figure 1-4 DSTREAM probe

Related concepts

1.6 Installing the USB drivers for the DSTREAM unit

To use the DSTREAM unit with a USB connection, the USB device drivers provided with Arm DS-5 must be installed for your operating system.

The drivers for DSTREAM are optionally installed as part of the install process for DS-5. If you have skipped the driver install process in DS-5, follow these steps to install them.

Procedure

- On Windows:
    1. Using administrative privileges, run the `driver_install.bat` batch file available in `DS-5_install_directory\sw\driver_files` directory.
    2. In the DS-5 **Driver Installation Wizard**, click **Next** and follow the steps.

        ———————— **Note** ————————

        During installation, you might receive warnings such as **Windows can't verify the publisher of this driver software**. You can safely ignore these warnings and continue with the installation.

        ————————————————————

    3. After the drivers are installed, click **Finish**.
- On Linux:
    1. Using root privileges, run the `run_post_install_for_ARM_DS-5_vx.x.sh` script file available in the DS-5 install directory. The `x.x` in the filename denotes the DS-5 version that is installed on your workstation.
    2. Enter `yes` to confirm the installation.

The USB drivers are now installed on your workstation.

1.7   Updating the DSTREAM firmware

The DSTREAM firmware contains specific sections of code for each Arm processor. These are called templates. Each template defines how to communicate with the device and the settings that you can configure.

Firmware updates are supplied with Arm DS-5. You must ensure that the firmware in use meets the minimum version required by DS-5.

In DS-5, the latest firmware files are available at: `DS-5_install_directory`\sw\debughw\firmware\

To install or update the firmware on DSTREAM, use the *Debug Hardware Firmware Installer* view in DS-5. To view the **Debug Hardware Firmware Installer** in DS-5, from the main menu, select **Window > Show View > Other > Debug Hardware Firmware Installer**.

Related concepts

1.8 The DSTREAM host software

The DSTREAM host software provides the interface between your debugger and the DSTREAM hardware that controls the target devices.

It translates debugger commands, such as start, stop, and download, into control sequences for a particular processor. The debug software provides support for debugging on a wide range of Arm processors. To see a list of supported processors, open the installed Update utility, connect to your debug hardware, and expand the **Templates** tree and sub-trees. A list of templates for all supported processors is displayed.

The DSTREAM software:

- Can address each target device individually, without affecting other devices on the board. It uses this ability to create virtual connections for each of the JTAG devices on the board. Your debugger can attach to one of these virtual connections, and perform debugging operations with no knowledge of the other devices on the board.
- Enables multiple concurrent connections. You can debug or control multicore systems from a single client debugger, or you can debug or control distinct devices in the system from separate client debuggers. Depending on the system, the software can also perform a synchronized start or stop of processors, for debugging multiprocessor systems where the processors interact with each other. For more information on the capabilities of multicore debug and synchronization, see the DS-5 Debugger documentation.
- Supports connections across a network, so that you can run the debugging software on several different computers.

The DSTREAM hardware and software supports multiple concurrent connections from single or multiple clients.

Related concepts

1.4 The DSTREAM unit on page 1-13

1.5 The DSTREAM probe on page 1-16

1.7 Updating the DSTREAM firmware on page 1-19

Related information

Using the Debugger

Debugger Command Reference

1.9 Troubleshooting your DSTREAM unit

Your DSTREAM unit indicates any problems using various LEDs.

Perform these basic checks before looking at the more in-depth problems.

Procedure

1. Ensure all the cables are connected and seated properly.
2. Observe the progress of the boot sequence to confirm that your DSTREAM unit is booting properly.
3. Fix the problem indicated by the LEDs on the unit:
   - If the STATUS LED flashes red, it signifies that a boot failure has occurred.
   - If the *Dynamic Host Configuration Protocol* (DHCP) LED illuminates red when an Ethernet cable is connected and the link light on the Ethernet socket illuminates, it indicates that the unit has failed to obtain an IP address.

   ———— **Note** ————
   The DHCP LED is accessible through the access panel on the underside of the unit.
   ————————

Related concepts
1.4 The DSTREAM unit on page 1-13
1.5 The DSTREAM probe on page 1-16
1.10 DSTREAM unit boot sequence on page 1-22
Related tasks
1.11 Restoring a DSTREAM unit that fails to boot on page 1-23

1.10   DSTREAM unit boot sequence

Your DSTREAM unit goes through a boot sequence when you power it up. The progress of the boot sequence is identified by various LEDs.

The DSTREAM unit follows this boot sequence:

1. The DSTREAM backlight illuminates blue.
2. The FLASH LED flashes as accesses take place.
3. The STATUS LED flashes green and then stays illuminated, and the blue power LED on the DSTREAM probe illuminates.

   If the target is connected and powered, the TARGET LED illuminates green, and the appropriate VTREF LED on the DSTREAM probe illuminates.

   The unit is now ready for use.

Related concepts

1.4 The DSTREAM unit on page 1-13

1.5 The DSTREAM probe on page 1-16

Related tasks

1.9 Troubleshooting your DSTREAM unit on page 1-21

1.11 Restoring a DSTREAM unit that fails to boot

You must perform a hardware reset and a firmware update if your DSTREAM unit fails to boot.

Procedure

1. Press and hold the reset button on the DSTREAM unit for approximately 10 seconds.

2. When the STATUS LED flashes red, release the button. The unit is now in recovery mode, and the STATUS LED flashes alternately red and green.

3. Use the installed Update utility to install a working firmware. The unit then reboots into normal mode.

Next Steps

──────── **Note** ────────

While in recovery mode, debug and trace operations are not enabled. You must perform a firmware update to restore full functionality.

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Chapter 2
System requirements for using Arm DSTREAM

Describes the system requirements for Arm DSTREAM and how to connect the DSTREAM unit to your host computer and target system.

It contains the following sections:

2.1 Requirements for connecting the DSTREAM unit

The parts you require depend on what you are connecting to the DSTREAM unit.

You require the following parts to connect the DSTREAM unit between your workstation and the target hardware:

- The DSTREAM unit.
- The external power adapter for the DSTREAM unit.
- The mains cable for the external power adapter that is appropriate for your region.
- One of the following cables, to connect the DSTREAM unit to the PC or the network:
  — The USB cable, to connect the DSTREAM unit directly to the PC using the USB port.
  — The RJ-45 Ethernet cable, to connect the DSTREAM unit to the network.
- One of the following cables, to connect the DSTREAM unit to the target hardware:
  — The target-compatible JTAG cable.
  — The Mictor cable if you want to perform trace.

You must also provide the following items:
- A host computer that conforms to the host software and hardware requirements.
- Some target hardware containing a debug interface supported by DSTREAM.

Related concepts

2.3 About hot-plugging and unplugging the debug cable on page 2-28

2.4 About tracing with DSTREAM on page 2-29

1.2 DSTREAM product contents on page 1-11

Related tasks

2.2 Connecting the DSTREAM unit on page 2-26

2.5 Tracing with DSTREAM on page 2-30

2.2 Connecting the DSTREAM unit

You must connect the DSTREAM unit to your host computer and to the target hardware using the appropriate cables and connector.

Prerequisites

Before setting up the DSTREAM hardware, ensure that you have all the relevant items that comprise the DSTREAM product kit.

———— Note ————

- If the DSTREAM unit or the target hardware are not properly earthed, potential differences can occur between them, causing unwanted pulses in the debug interface during connection. This can cause unwanted resets to occur.
- If using targets with a power supply voltage greater than 5V, Arm recommends observing one or both of the following precautions.
  1. Disconnect the target from the DSTREAM unit before powering.
  2. Ensure that the target is plugged into its external power adapter before plugging the external power adapter into the wall socket. This step ensures that when the target powers, it is properly grounded through its own power supply.

Procedure

1. Connect the host computer to the DSTREAM unit as shown in the following figure, using either the USB port or a TCP/IP network connection, as required:
   - If you are connecting using the USB port, connect one end of the supplied USB cable to a USB port on the host computer, and the other end of the cable to the USB port on the DSTREAM unit.

     ———— Note ————

     The USB drivers are installed with the debug host software.

   - If you are connecting across an Ethernet network, connect the Ethernet port of the DSTREAM unit to a socket for the Ethernet network using the supplied RJ-45 Ethernet cable.
   - If you are using a cross-over cable (not supplied), connect one end of the cable to the Ethernet port of the host computer, and the other end to the Ethernet port of the DSTREAM unit.
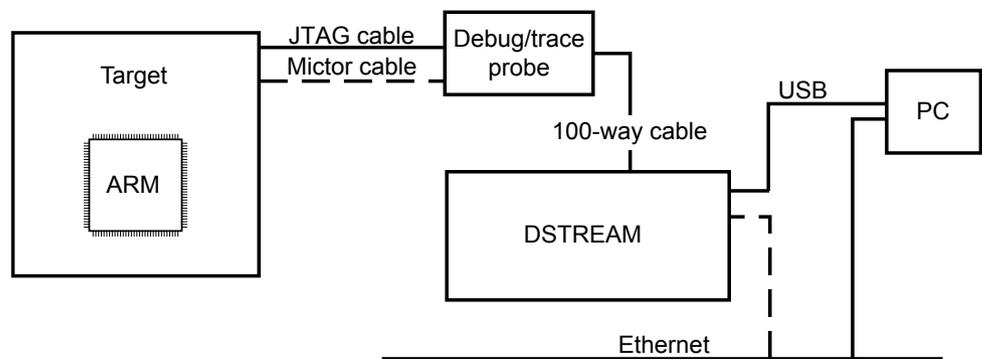
Figure 2-1 Connecting the DSTREAM hardware

2. Connect the DSTREAM unit to the target hardware, using the appropriate debug or trace cables:
   - Connect one end of the supplied 100-way cable to the DSTREAM unit, and connect the other end of the cable to the probe unit.
   - Connect the target hardware to the probe using the appropriate cables and connector.

   All connectors are keyed to prevent incorrect connections.

3. Power-up the target hardware and power-up the DSTREAM unit.

4. Configure the IP address on a debug hardware unit using the installed ConfigIP utility. This enables you to access your unit by Ethernet. (You do not have to do this if you are using a USB connection).

Related concepts

1.5 The DSTREAM probe on page 1-16

2.1 Requirements for connecting the DSTREAM unit on page 2-25

2.3 About hot-plugging and unplugging the debug cable on page 2-28

2.4 About tracing with DSTREAM on page 2-29

Related tasks

2.5 Tracing with DSTREAM on page 2-30

2.3 About hot-plugging and unplugging the debug cable

There are times when you might want to connect or disconnect a debug cable without powering off the target. You can do this provided certain conditions exist.

You can connect and disconnect the DSTREAM unit to the target hardware without affecting operation of the target if:

- The DSTREAM unit is powered by its original, earthed-output power supply.
- The target hardware is earthed either through its PSU or separate earth connection.

——————— Note ———————

- If the DSTREAM unit or the target hardware are not properly earthed, potential differences can occur between them, causing unwanted pulses in the debug interface during connection. This can cause unwanted resets to occur.
- If using targets with a power supply voltage greater than 5V, Arm recommends observing one or both of the following precautions.
  1. Disconnect the target from the DSTREAM unit before powering.
  2. Ensure that the target is plugged into its power adapter before plugging the power adapter into the wall socket. This step ensures that when the target powers, it is properly grounded through its own power supply.

————————————————

You might want to connect the debug cable if you have a target that is operating without a DSTREAM unit connected and you want to examine the target to find out why it is behaving in a particular way. To do this, you must power-up the DSTREAM unit and configure the connection without affecting the state of the target. This requires that the DSTREAM unit is powered before it is connected to the target.

When unplugging the debug connector, you must be aware that:

- If you are using an RTCK system, make sure that no communication is taking place between the system and the DSTREAM unit. Otherwise, if the DSTREAM unit is waiting for a return clock, it might lock up.
- If you are not using an RTCK system, the debug software can handle this situation. However, you must arrange to do a *Test Access Port* (TAP) reset using the debugger when you next plug the DSTREAM unit into a target. This can be performed during the advanced configuration part of the process.

Related concepts

2.1 Requirements for connecting the DSTREAM unit on page 2-25
2.4 About tracing with DSTREAM on page 2-29

Related tasks

2.2 Connecting the DSTREAM unit on page 2-26
2.5 Tracing with DSTREAM on page 2-30

2.4 About tracing with DSTREAM

DSTREAM is capable of capturing trace data into a cyclic buffer, and you can define the buffer size up to a maximum of 4GB.

When a sufficient amount of trace data has been captured to fill the buffer, the FULL LED illuminates. The buffer then wraps, continues to capture trace data, and overwrites the original trace data captured.

You can stop trace capture by using a trigger condition or a manual stop, and you can configure the amount of trace captured after a trigger event.

──────── Note ────────

See the DS-5 debugger documentation for details of the trace capabilities, and for configuring trace.

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Related concepts

2.1 Requirements for connecting the DSTREAM unit on page 2-25

2.3 About hot-plugging and unplugging the debug cable on page 2-28

1.4 The DSTREAM unit on page 1-13

Related tasks

2.2 Connecting the DSTREAM unit on page 2-26

Related information

Using the Debugger

Debugger Command Reference

2.5 Tracing with DSTREAM

You can capture trace with your DSTREAM unit and a supported debugger.

Procedure

1. Connect your DSTREAM unit using Ethernet or USB.

   When you have connected DSTREAM to your host computer, you are ready to begin using DSTREAM with your debugger.

2. See the documentation that accompanies your debugger for information on using DSTREAM to capture trace.

Related concepts

1.4 The DSTREAM unit on page 1-13

2.1 Requirements for connecting the DSTREAM unit on page 2-25

2.3 About hot-plugging and unplugging the debug cable on page 2-28

2.4 About tracing with DSTREAM on page 2-29

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