

Introduction

Thanks for choosing ST7! This manual will help you set up and start using your ST7-EMU3 emulator.

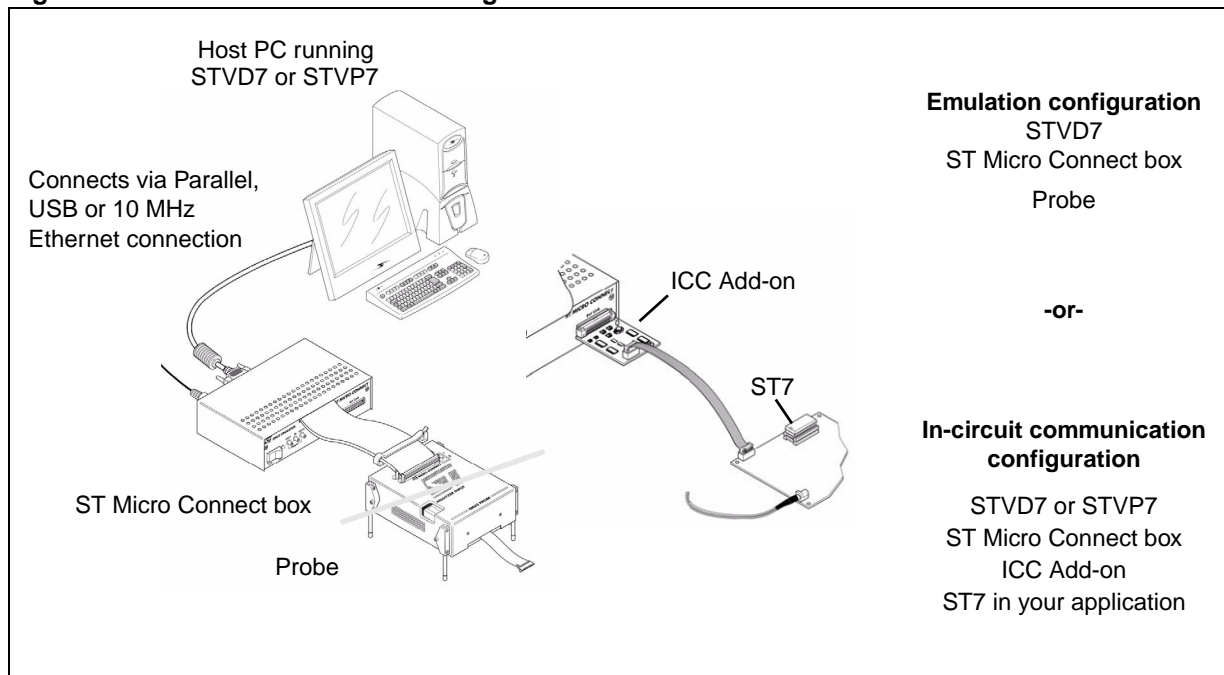
The ST7-EMU3 emulator is the latest generation of ST7 emulators. In combination with the ST7 debugging and programming software, it gives you unprecedented control of application development - from building and debugging your applications to programming your ST7 microcontroller.

The ST7-EMU3 emulator gives you start-to-finish control of application development by providing you with emulation and in-circuit communication (ICC) configurations. The ST Micro Connect box is your common hardware interface for emulation and in-circuit debugging and programming.

In the emulation configuration, your emulator's probe and ST7 Visual Develop (STVD7) software allow you to build and debug your application software. This configuration gives you the most complete range of debugging features, including advanced breakpoints and performance analysis.

In the in-circuit communication configuration, the ICC Add-on and STVD7 allow you to debug your application while it runs on your ST7, and to program your ST7 microcontroller with ST7 Visual Programmer (STVP7).

Figure 1. ST7-EMU3 emulator configurations



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1 Overview

1.1 About the user manuals

This manual will help you set up your ST7-EMU3 emulator and connect it to your PC. Here, you will find:

- Quick set up instructions for the emulation and in-circuit communication configurations
- Detailed hardware information
- A troubleshooting guide for your emulator

For information about the hardware and software intended for use with your emulator, refer to the following documents that are included with it:

- *ST7-EMU3 Probe user guide*- for instructions about connecting your ST7MDTxx-EMU3 emulator to your application board.
- *ST7-EMU3 Emulation Characteristics*- for a detailed description of characteristics specific to your ST7MDTxx-EMU3's Target Emulation Board (TEB).
- *ST7 Visual Develop on-line help*- build and debug your application software.
- *ST7 Visual Programmer on-line help* - program your ST7.
- *ST7xxx Datasheet* - ICC connection information that is specific to your ST7.

1.2 Host PC system requirements

Both the hardware and software components of the ST7-EMU3 emulator have been designed to operate with:

- One of the following operating systems: Microsoft® Windows® 98, 2000, Millennium, NT® or XP®.
- Intel® Pentium (or compatible) processor with minimum speed of 133 MHz.
- Minimum RAM of 32 MB (64 MB recommended).
- 50 MB of free hard disk space to install all of the ST7 tools.

Note: To install STVD7 and STVP7, Windows® 2000, NT® and XP® users must have administrator privileges.

1.3 Getting assistance

For more information, application notes, FAQs and software updates for all the ST microcontroller families, check out the CD-ROM or our website: www.st.com

For assistance on all ST microcontroller subjects, or for help using your emulator, refer to the contact list provided in [Product support](#). We'll be glad to help you.

2 Getting Started with ST7-EMU3

Your ST7-EMU3 emulator can be configured for emulation, as well as in-circuit debugging and programming of your ST7 microcontroller.

To help you get started, the following sections provide:

[Section 1.1](#) – a checklist of components included with your emulator

[Section 1.2](#) – quick set up instructions for the emulation configuration

[Section 1.3](#) – quick set up instructions for the in-circuit communication configuration

2.1 Delivery check list

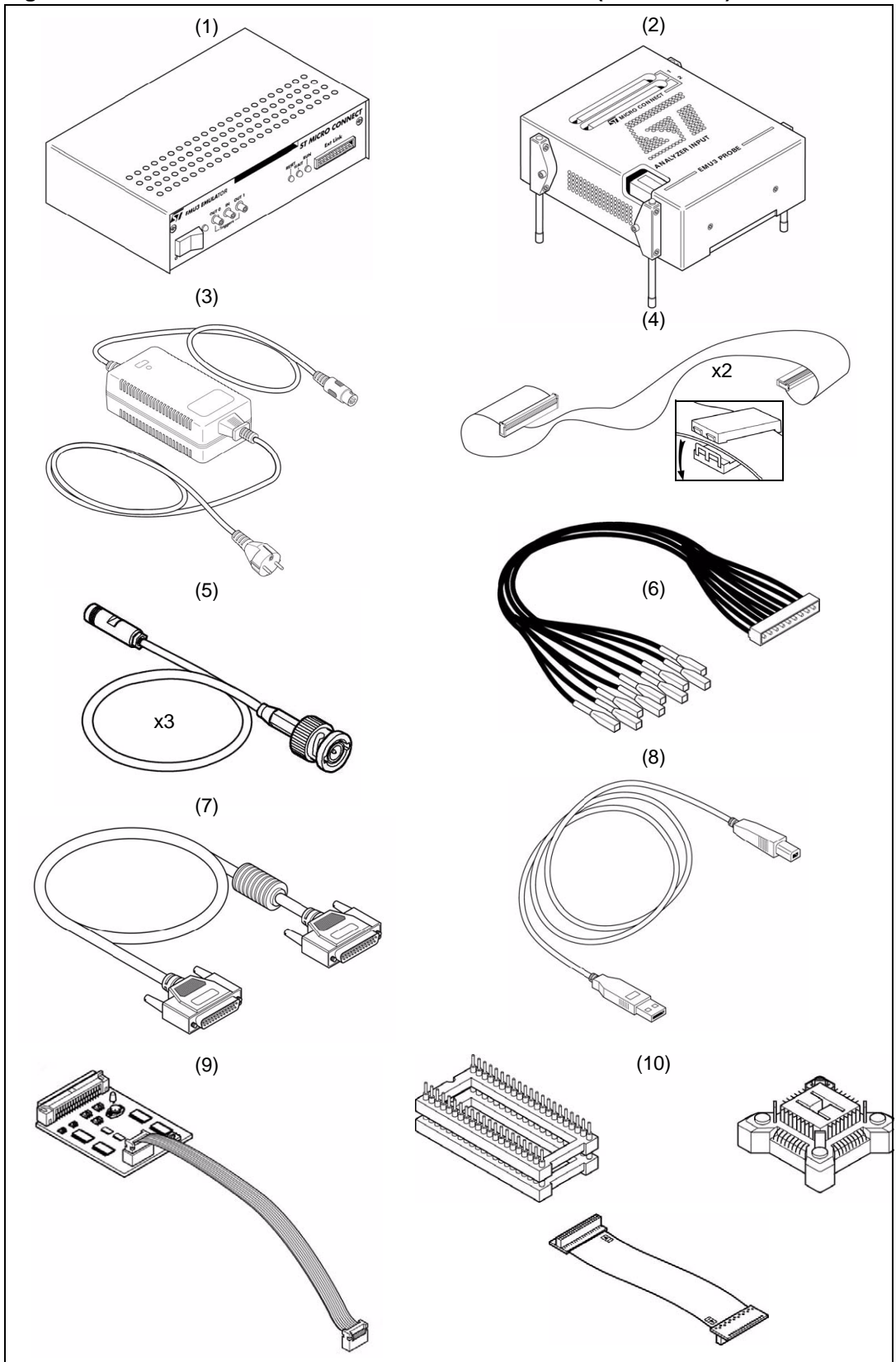
The ST7-EMU3 emulator comes with (refer to [Figure 2](#)):

1. One ST Micro Connect box.
2. One EMU3 probe containing a target emulation board (TEB) corresponding to the ST7 you wish to emulate.
3. One DC power supply for the ST Micro Connect box.
4. Two 80-wire flat cables and two ferrite clips.
5. Three trigger cables.
6. One 9-wire, analyzer-input cable.
7. One parallel cable and one USB cable for emulator-PC connection, One DB9F/DB9M serial cable (not shown) for Ethernet configuration.
8. One ICC Add-on (STMC ICC board, ICC cable with HE10 connectors).
9. Device adapters (refer to the *ST7xxxx-EMU3 Probe User Guide*).

All ST7-EMU3 emulator s also come with the following documentation:

- This manual
- *ST7xxxx-EMU3 Probe User Guide*
- *ST7 ASM Quick Reference Guide*
- *ST Product and Tool Selection Guide*
- The Microcontroller Development Tools CD-ROM with all the software you need to run your ST7-EMU3 emulator, including:
 - The ST7 Visual Develop (STVD7) software with user manual in Adobe® Acrobat® PDF format.
 - The ST7 Visual Programmer (STVP7) software, which includes an online help file to get you started.
 - The ST7 Assembler-Linker software with user manual in Adobe® Acrobat® PDF format.
 - Software demonstration packages, including C compilers and toolchains by Cosmic and Metrowerks.
- The ST Microcontrollers Mini-ROM with a presentation of the ST family of microcontrollers.

Figure 2. Parts delivered with the ST7-EMU3 emulator (not to scale)



2.2 Quick set up for emulation configuration

1. Connect your PC to your ST Micro Connect box via parallel, USB or Ethernet port. For more details refer to [Chapter 3: Connectivity on page 9](#). For Ethernet connections, you must assign your ST Micro Connect box an IP address. For instructions refer to [Section 3.3: Ethernet connection on page 12](#).

Caution: Before connecting your emulator and your application board, make sure that both your ST Micro Connect box and the application board are powered OFF.

Figure 3. Connect your PC

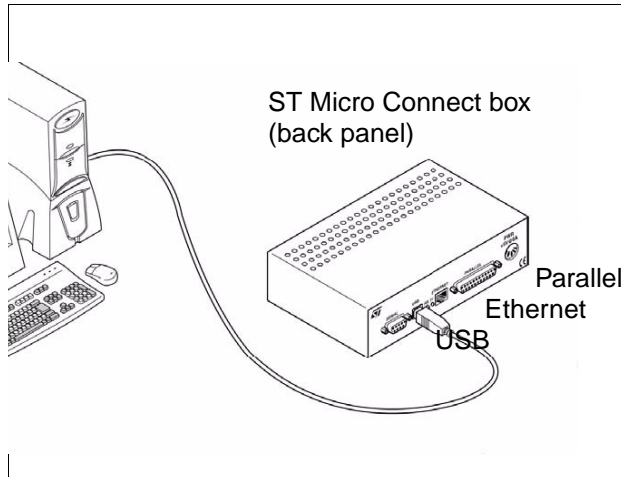
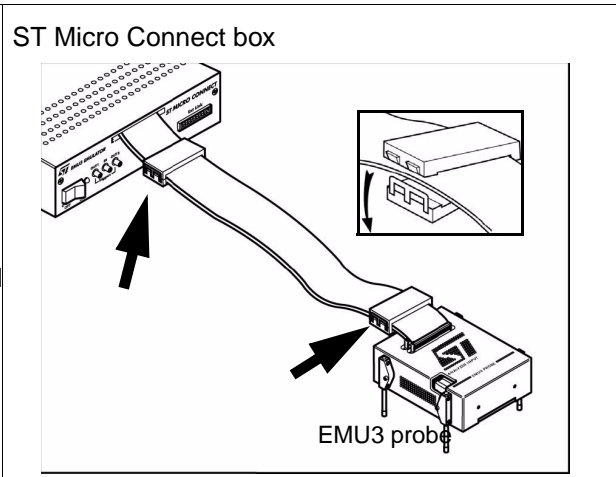


Figure 4. Fasten the ferrite clips



2. Fasten ferrite clips to the 80-wire flat cables connecting the ST Micro Connect box to your EMU3 probe (see [Figure 4](#)).
3. Connect your application board to the EMU3-probe. You can use the emulator without connecting to your application board. For details about connecting to your application board refer to your *ST7xxx-EMU3 Probe User Guide* provided with your emulator.

Caution: Never have your application board powered on while the emulator is powered off—this can cause serious damage to the emulator.

4. Connect the power supply to your ST Micro Connect box. For power supply information, refer to [Section 4.3.3: Power supply on page 19](#).
5. Power up your ST Micro Connect box.
6. Power up your application.

Caution: You must always power up your emulator and your application board before running your application executable in STVD7. Doing otherwise will result in an erroneous emulation.

2.3 Quick set up for in-circuit communication configuration

1. Connect your PC to your ST Micro Connect box via the parallel or USB ports. Ethernet is not supported for in-circuit debugging and programming. For more details refer to [Chapter 3 on page 9](#).

Caution: In order to use the ICC Add-on you must design your application board with an HE10 connector linked to the microcontroller in your application. The pins connected to the HE10 connector must use a signal voltage of 3.3 or 5 V. For more information refer to [Section 5.2: ICC connection requirements on page 25](#).

Figure 5. Connect your PC

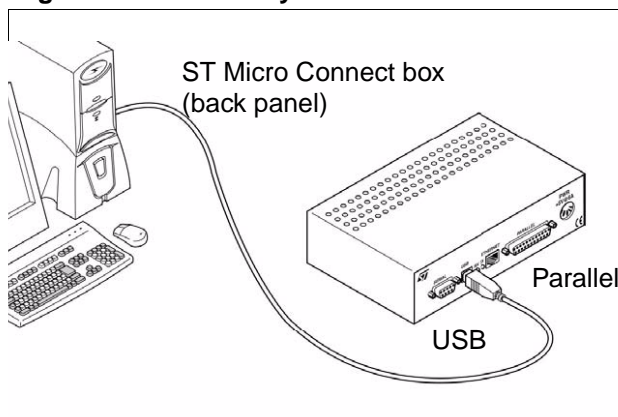
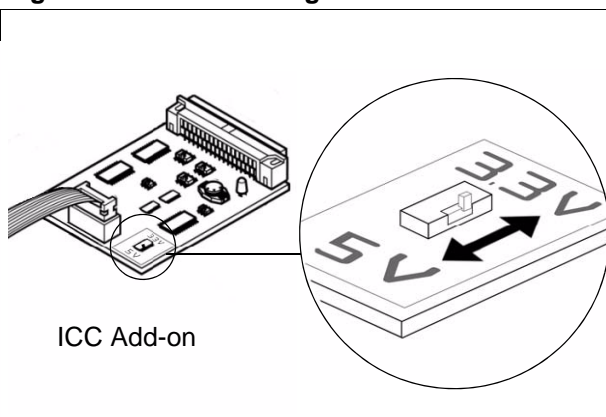
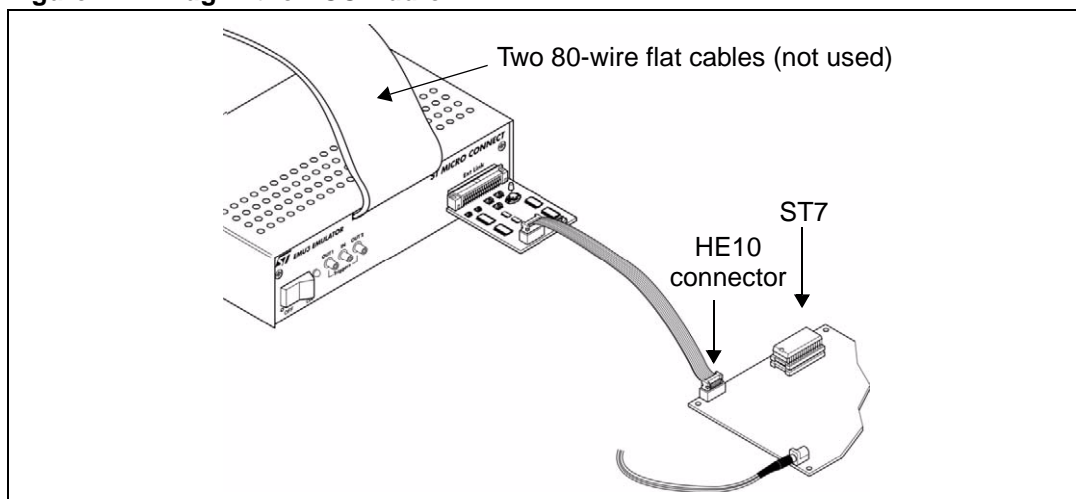


Figure 6. Select voltage



2. Select the voltage (3.3 or 5 V) with the selector switch on the board of your ICC add-on. For more information on voltage specifications, refer to [Section 5.3: ICC Add-on on page 28](#).
3. Plug the ICC Add-on into the 'Ext Link' on your ST Micro Connect box.
4. Plug the ICC Add-on into the HE10 connector on your application board.
5. Power up your ST Micro Connect box.
6. Power up your application.

Figure 7. Plug in the ACC Add-on



3 Connectivity

The ST Micro Connect box provides three possible connections to the host PC: parallel port, USB and Ethernet. The type of connection that you use will be determined, in part, by the configuration you choose for your EMU3 emulator.

In the in-circuit communication configuration, you can use either the USB or the parallel port. Ethernet is not supported in this configuration. In the emulation configuration you can use the Ethernet, USB or parallel port.

When you start your emulation, in-circuit debugging or in-circuit programming sessions, you will have to set the connection type in STVD7 or STVP7. In STVD7, set the port in the **Debug Instrument Settings** window (*Debug Instrument>Target Settings*). When programming your ST7 with STVP7, set the port in the **Configuration** window (*Configure>Configure ST7 Visual Programmer*). For more information refer to your software's online help.

The following sections provide you with information about supported connections, as well as how to connect your PC via:

- [Section 3.1](#) – Parallel port
- [Section 3.2](#) – USB port
- [Section 3.3](#) – Ethernet port

3.1 Parallel port

Your EMU3 emulator supports the parallel port connection modes listed in [Table 1](#), when using either the emulation or the in-circuit communication configurations.

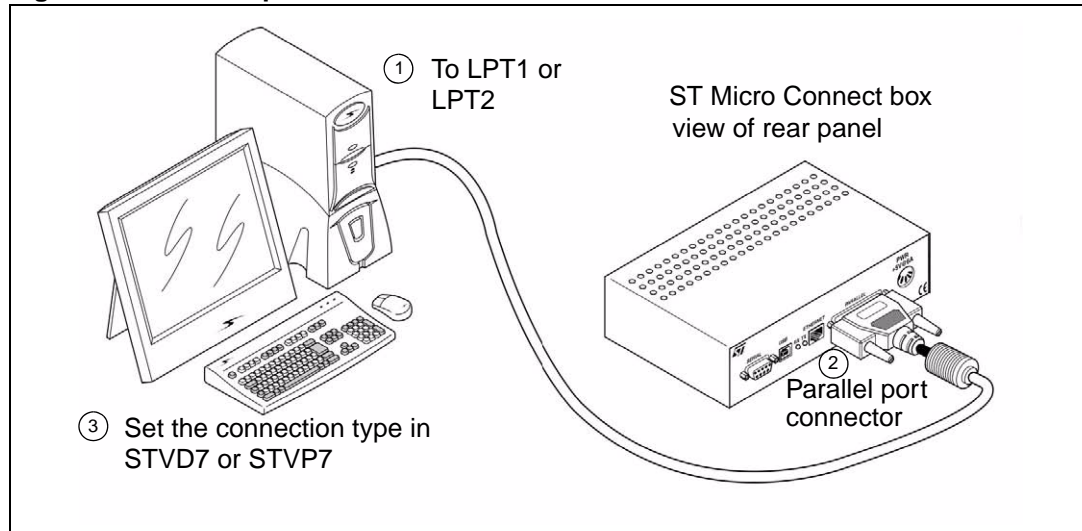
Table 1. Supported parallel port connection modes

EMU3 emulator configuration	Operating systems	Compatible parallel port modes
Emulation, In-circuit Communication	Windows® 98, Millennium, NT®4, 2000, XP	ECP ⁽¹⁾ , Bidirectional, Compatible, SPP, Nibble, Centronics or EPP.

1. ECP mode is normally chosen as a default mode as it provides the best performance.

3.1.1 Connecting to the parallel port

Figure 8. Parallel port connection between ST Micro Connect box and PC



To connect your emulator to your PC, connect the end of the parallel cable with the ferrite to the ST Micro Connect's rear panel 25-pin SUB-D connector (see [Figure 8](#)). Connect the other end of the parallel cable to one of the PC's parallel ports (LPT1 or LPT2). Be sure to use the parallel cable provided with your emulator. Using a longer parallel cable may cause emulator malfunctions. The use of switch boxes between the parallel port connector of your PC and the emulator is not recommended.

3.1.2 Changing the parallel port set up

Under certain circumstances, you may receive the following error message:

```
Connection Error (LPT1/LPT2): Interconnection failure. Verify your
input/output cable.
```

This may mean that the setup of the LPT1 or LPT2 port on your PC is not compatible with the emulator. To set up the port correctly:

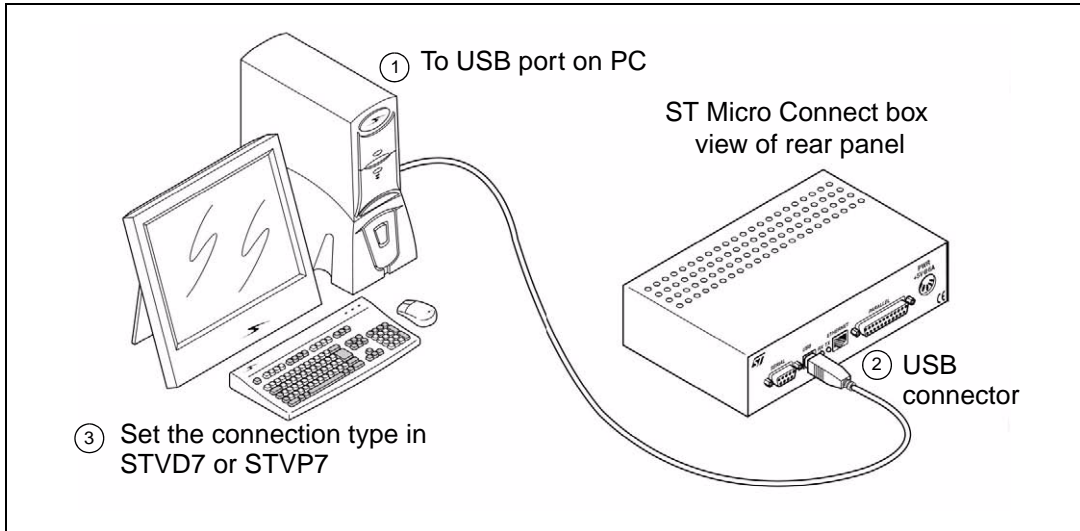
1. Shut down and restart your PC in order to enter the BIOS setup.
2. Follow the messages displayed on the screen and when prompted, press the key required to enter the BIOS setup (usually a function key or the ESC key).
3. Select the parallel ports menu (this may be listed under I/O ports).
4. Change the Mode of the LPT port that you have chosen for your ST Micro Connect box (i.e. either LPT1 or LPT2) to one of the compatible modes listed in [Table 1](#) on page 9.
5. Save your changes and exit the BIOS setup.

3.2 USB port

Your EMU3 emulator supports USB connection in both the emulation and in-circuit communication configurations, when using Windows® 98, Millenium, 2000 and XP®.

3.2.1 Connecting to the USB port

Figure 9. USB connection between ST Micro Connect box and PC



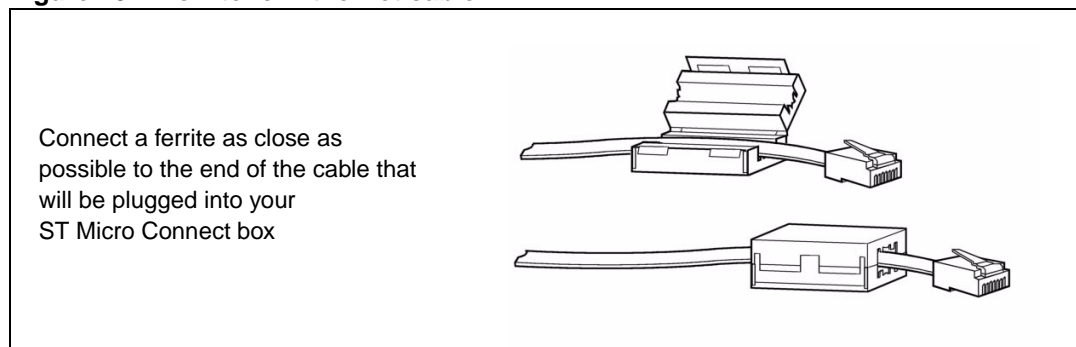
For USB port connections, plug the USB cable into the USB port of the ST Micro Connect box (as shown in [Figure 9](#)) and connect the other end into the PC's USB port. Once the ST Micro Connect box is connected and powered-on for the first time, your PC will automatically look for a USB device driver.

3.3 Ethernet connection

Your EMU3 emulator supports 10 MHz Ethernet connections when set up in the emulation configuration. When you program with the ICC Add-on, use the parallel or the USB port.

For Ethernet connections, you must first give your ST Micro Connect box an IP address in order for it to be recognized as a device on your network. If your ST Micro Connect box has not been assigned an IP address, refer to [Section 3.3.1](#) on page 12 for detailed instructions.

Figure 10. Ferrite for Ethernet cable



Once you have assigned an IP address to the ST Micro Connect box, connect it to your network using the Ethernet connector on the rear panel. To reduce signal noise, you should attach the provided ferrite to your Ethernet cable as shown in Figure 8. The ferrite should be placed as close as possible to the end that is plugged into your ST Micro Connect box. The Ethernet cable is not provided with your EMU3 emulator.

3.3.1 Assigning an IP address

To give your ST Micro Connect box an IP address do the following:

1. Connect the provided serial cable between the serial port of your ST Micro Connect and a serial port on your PC (either COM1 or COM2).

Note: To set the IP address, you must use a direct serial cable like the one provided (i.e. the PC-side Receive Data pin (Rx) connects directly to the emulator-side Rx pin and the PC-side Transmit Data pin (Tx) connects directly to the emulator-side Tx pin). You cannot use a serial cable with an inverted connection (Rx pin connected to Tx pin).

2. From Windows, open a **Hyperterminal** window. This is done by selecting **Start>Programs>Accessories>Communications>Hyperterminal**.
3. If the Hyperterminal software is not installed on your system, you will have to install it from your Windows[®] CD-ROM, by selecting **Start>Settings>Control Panel>Add/Remove Programs>Windows Setup**, and clicking on the **Hyperterminal** option.
4. The **Connection Description** dialog box will open. Type in the name you wish to give to the new connection configuration and click **OK**, as shown in [Figure 11](#).
5. When the **Connect To** dialog box opens, select the serial port on your PC that you connected the serial cable to in Step 1. Click **OK**.
6. When the **COM1 Properties** dialog box opens, configure the COM port properties as shown in [Figure 13](#). Click **OK**.
7. When the **Hyperterminal** console opens, type `ipaddr` at the prompt, followed by the IP address you wish to assign to your ST Micro Connect box. Remember that this IP

address must be unique on your network. In [Figure 14](#), we have used 164.129.123.244 as the IP address. Press the **Enter** key on your keyboard.

Figure 11. Hyperterminal new connection

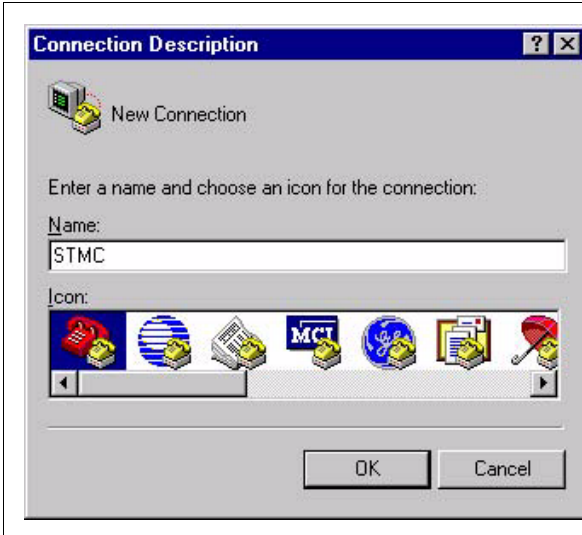
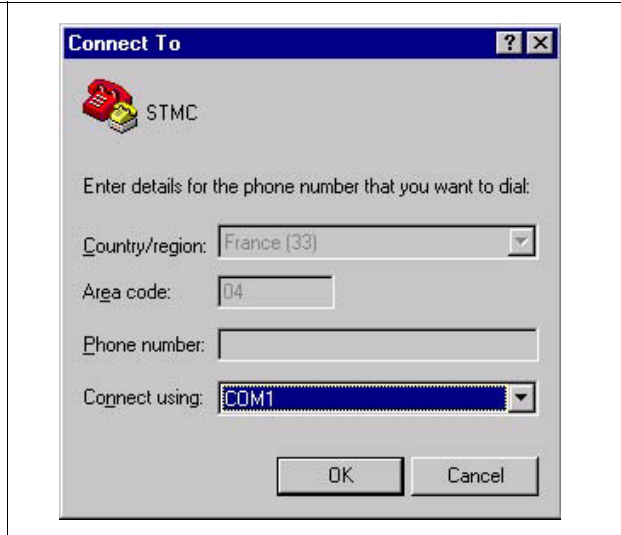
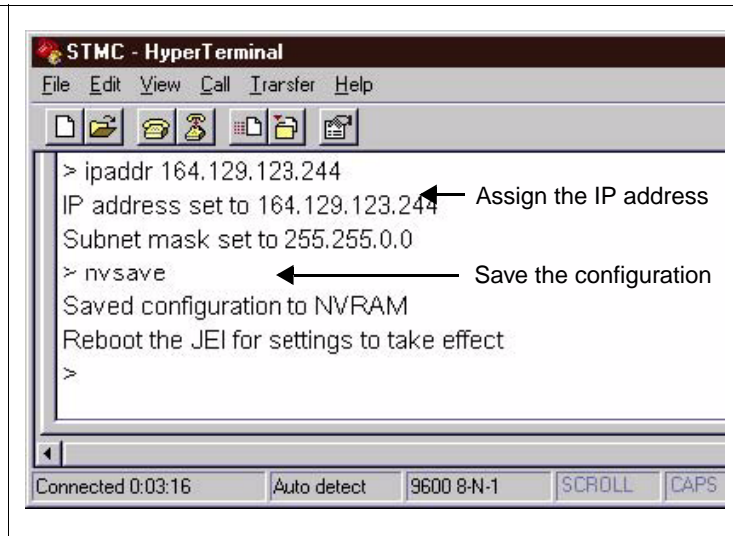
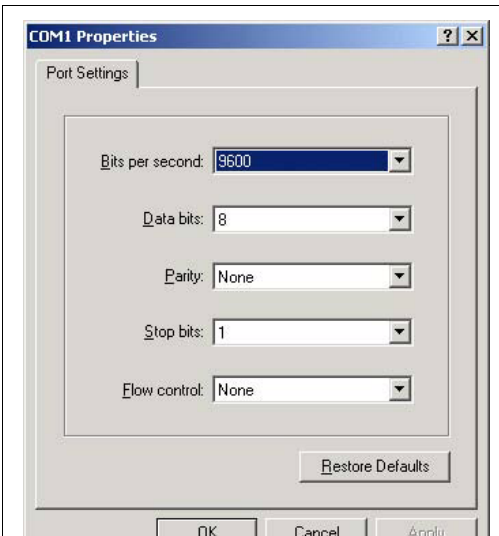


Figure 12. Connecting to a COM port



8. The **Hyperterminal** console will indicate that the IP address has been set, and will also report the submask.
9. At the prompt type `nvsave`, and press **Enter**, to save your configuration ([Figure 14](#)).

Figure 13. Configuring the COM port Figure 14. Configuration saved



10. The **Hyperterminal** console will indicate that your configuration has been saved
11. Exit the **Hyperterminal** console and disconnect the serial cable between your host PC and the ST Micro Connect box. Connect it to your network using an Ethernet connection.
12. Ensure that no application board is connected to your ST Micro Connect box, then reboot it by switching it off and then on again. When rebooted, your network will recognize the device by its new IP address.

4 Emulation configuration

In the emulation configuration, the ST7-EMU3 emulator provides you with a full range of emulation features to make building and debugging your application fast and easy. The following sections provide information about the emulation configuration, including descriptions of:

- [Section 4.2](#) – system architecture
- [Section 4.1](#) – overall emulation features
- [Section 4.3](#) – ST Micro Connect box features
- [Section 4.4](#) – EMU3 probe features
- [Section 4.5](#) – the dual configuration capability
- [Section 4.6](#) – automatic firmware updating
- [Section 4.7](#) – product limitations and discrepancies

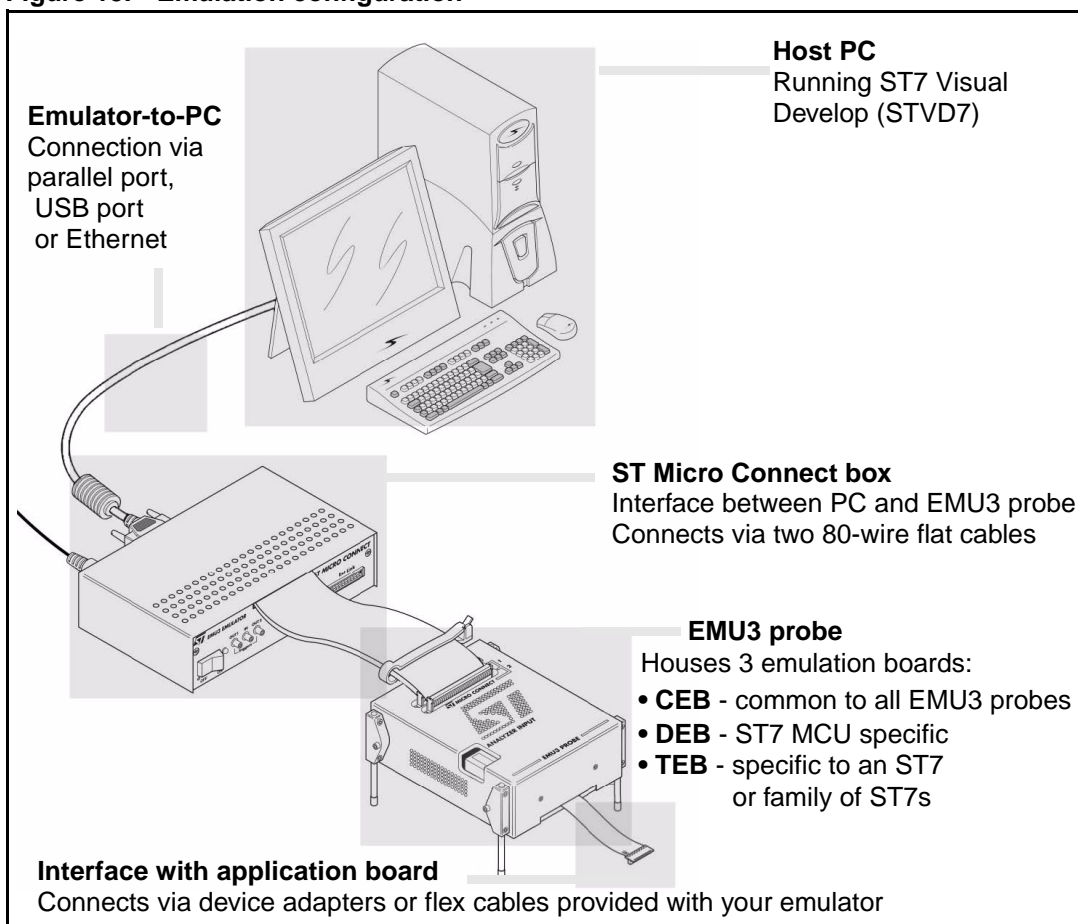
4.1 Emulation features

The features described below are common to all ST7 EMU3 emulators:

- Link to host PC via USB, 10 MHz Ethernet and parallel port connections.
- 2.5 to 5.5 V operating voltage (refer to your *ST7xxxx Datasheet*).
- Programmable internal CPU clock with frequency up to 24 MHz, depending on your ST7 (see your *ST7xxxx Datasheet*).
- 256k x 112-bit real-time trace (address, data and control buses).
- Advanced breakpoints based on a 4-level logical sequencer that allows you to perform specific actions upon the occurrence of an event or series of events. Advanced breakpoints functionality provides flexibility of use, permits simple or multi-level breakpoint conditions, control of trace recording and triggering of output signals.
- 9 external input triggers, which are recorded in the trace and can be used as signal events in the advanced breakpoints. Input triggers include:
 - 1 input trigger via SUB-click connector on the ST Micro Connect box
 - 8 input triggers on analyzer input
- 2 output triggers via SUB-click connectors on the ST Micro Connect box.
- Full access to entire 64 KB of ST7 memory. Read/write privileges on the entire memory space (see [Section 4.7.2](#) on page 23, regarding limitations). Granularity of memory mapping is 1.
- Read/Write on-the-fly feature allows you to intrusively read or write to memory while executing your application.
- Easily upgradable – the PLDs and firmware of the ST Micro Connect and the EMU3 probe are updated automatically by STVD7.
- Easily expandable – you can change the emulation target (i.e. the type of ST7 to be emulated) easily and economically by changing the target emulation board (TEB) in the EMU3 probe.

4.2 System architecture

Figure 15. Emulation configuration



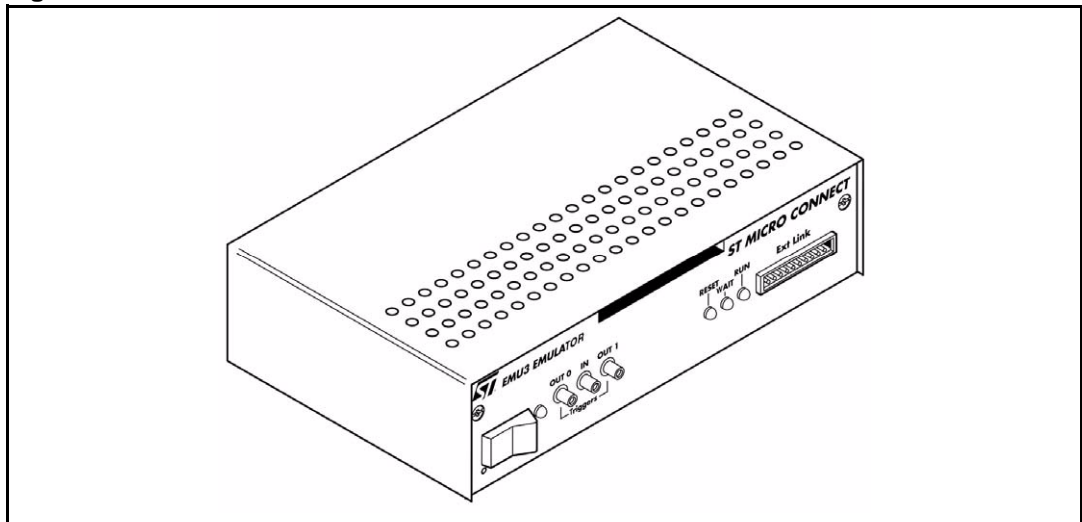
The ST7-EMU3 emulator is composed of:

- **ST7 Visual Develop (STVD7)**: software from which you can configure and control your emulator, and debug your application. It runs on your PC, which you connect to your emulator via a parallel, USB or Ethernet connection.
- The **Target Emulation Module** consisting of:
 - The **ST Micro Connect Box**, which contains the common resources for communication between the PC and emulation hardware. It links to a host PC via parallel, USB or Ethernet ports, and to the probe by way of two 80-wire flat cables.
 - The **probe**, which contains the active emulation hardware including the target emulation board (TEB). The target emulation board has the specific resources necessary to emulate an individual ST7, or family of ST7 microcontrollers. It also permits the connection to your application board.
- **Flex connectors** which are furnished in your emulator's connection kit and provide the connection between your emulator's TEB and your application board.
- **Adapters** which may be necessary for some device packages, when connecting to your application board.
- **Sockets** which you must install on your application board, allowing you to connect your emulator to the application in place of your ST7.

4.3 ST Micro Connect box

The ST Micro Connect box is a common hardware target interface for a range of ST7. It connects to your application via the EMU3 probe (emulation configuration) or the ICC Add-on (in-circuit communication configuration). Depending on the configuration and your PC's operating system, it allows you to connect your PC via parallel port, USB port or Ethernet connection.

Figure 16. ST Micro Connect box



4.3.1 Physical characteristics

Front panel

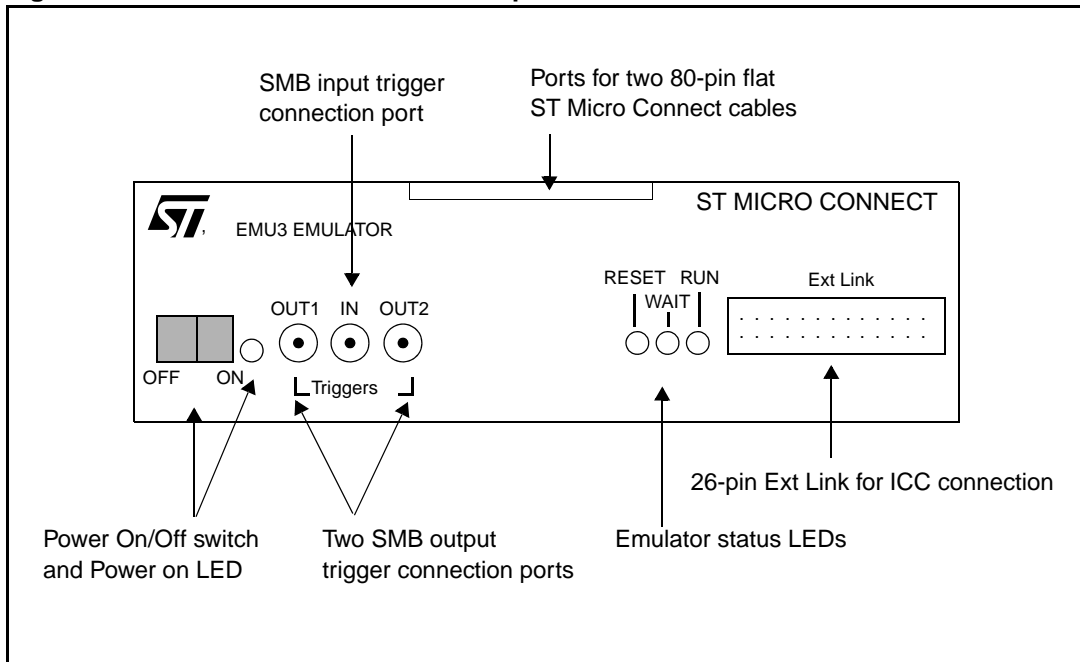
On the front panel of the ST Micro Connect box you will find:

- On/Off switch for the emulator,
- input and output trigger connectors,
- emulator status LEDs,
- 26-pin 'Ext Link,' for ICC connection,
- ports for two 80-pin flat cables that connect the ST Micro Connect box to the EMU3 probe.

The three emulator status LEDs on the front panel of the ST Micro Connect box indicate the state of the development tool during emulation:

- **Reset (Red)**—indicates that the ST7 emulation chip is being reset. In addition, there is one LED on the EMU3 probe, near the ST Micro Connect connectors, that lights when data is being communicated between the ST Micro Connect box and the EMU3 probe.
- **Wait (Yellow)**—indicates that emulator is in *halt* or *wait for interrupt* mode.
- **Run (Green)**—indicates that the ST7 application is running (the ST7 is not in RESET, WFI or HALT mode).

Figure 17. ST Micro Connect box front panel

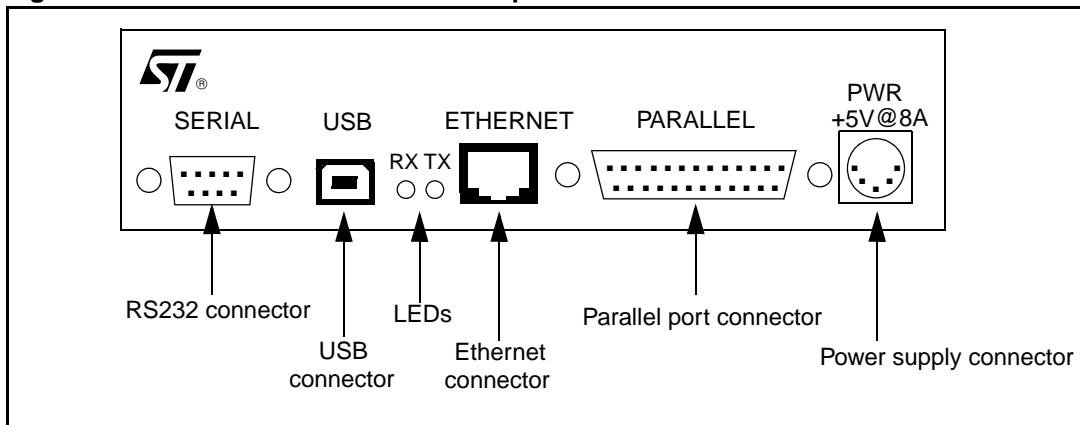


Rear panel

The rear panel houses the following connectors:

- RS232 serial connector.
- USB port connector.
- Ethernet connector.
- parallel port connector.
- power input connector.

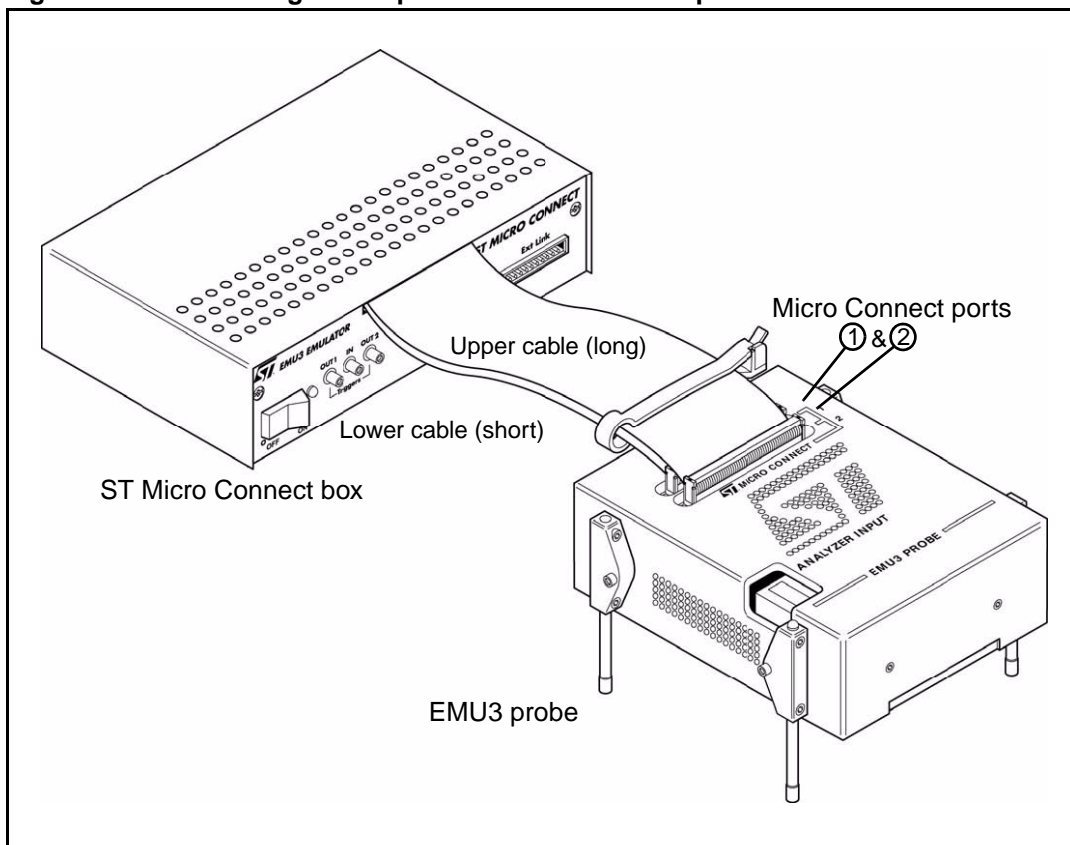
Figure 18. ST Micro Connect box back panel



4.3.2 Probe connection cables

The ST Micro Connect box connects to your EMU3 probe via the two 80-wire flat cables coming from the front panel. When you receive your emulator, the ST Micro Connect box and the probe should already be connected (see [Figure 19](#)).

Figure 19. Connecting the 80-pin cables to the EMU3 probe



To disconnect or reconnect the cables, do the following:

To disconnect the probe

1. Power off your application board and the ST Micro Connect box.
2. Unplug the long, 80-wire flat cable that is connected to **port number 2** on top of the probe. Grasp the sides of the plug, squeeze to release the two metal locks and pull upwards, unplugging the cable from the port.
3. Unplug the short, 80-wire flat cable that is connected to **port number 1** in the same manner.

To reconnect the probe

Plug the 80-wire flat cables back into their ports.

- The short 80-wire flat cable (bottom) always plugs into port number 1.
- The long 80-wire flat cable (top) always plugs into port number 2 (see [Figure 19](#)).

4.3.3 Power supply

The **power supply** for your emulator connects to the rear panel of the ST7 Micro Connect box (see [Figure 18](#)). When you connect the power supply be sure to:

1. Ensure that the operating voltage (110 Volts/220 Volts), which is indicated on the label on the power supply, matches your mains supply. Contact your dealer if this voltage does not correspond to your mains supply.
2. Connect the external power supply provided with the emulator to the rear panel of the ST Micro Connect box using the 5-pin DIN connector.
3. Plug the power supply into the mains using the supply cable provided.
AC voltage: 100 V to 240 V
Frequency: 50 to 60 Hz

4.3.4 Output and Input triggers

Your ST Micro Connect box has two output triggers (OUT1, OUT2), and one input trigger (IN), which are available via SUB-click connectors located on the front panel (see [Figure 17](#)). Both input and output signals are at TTL level.

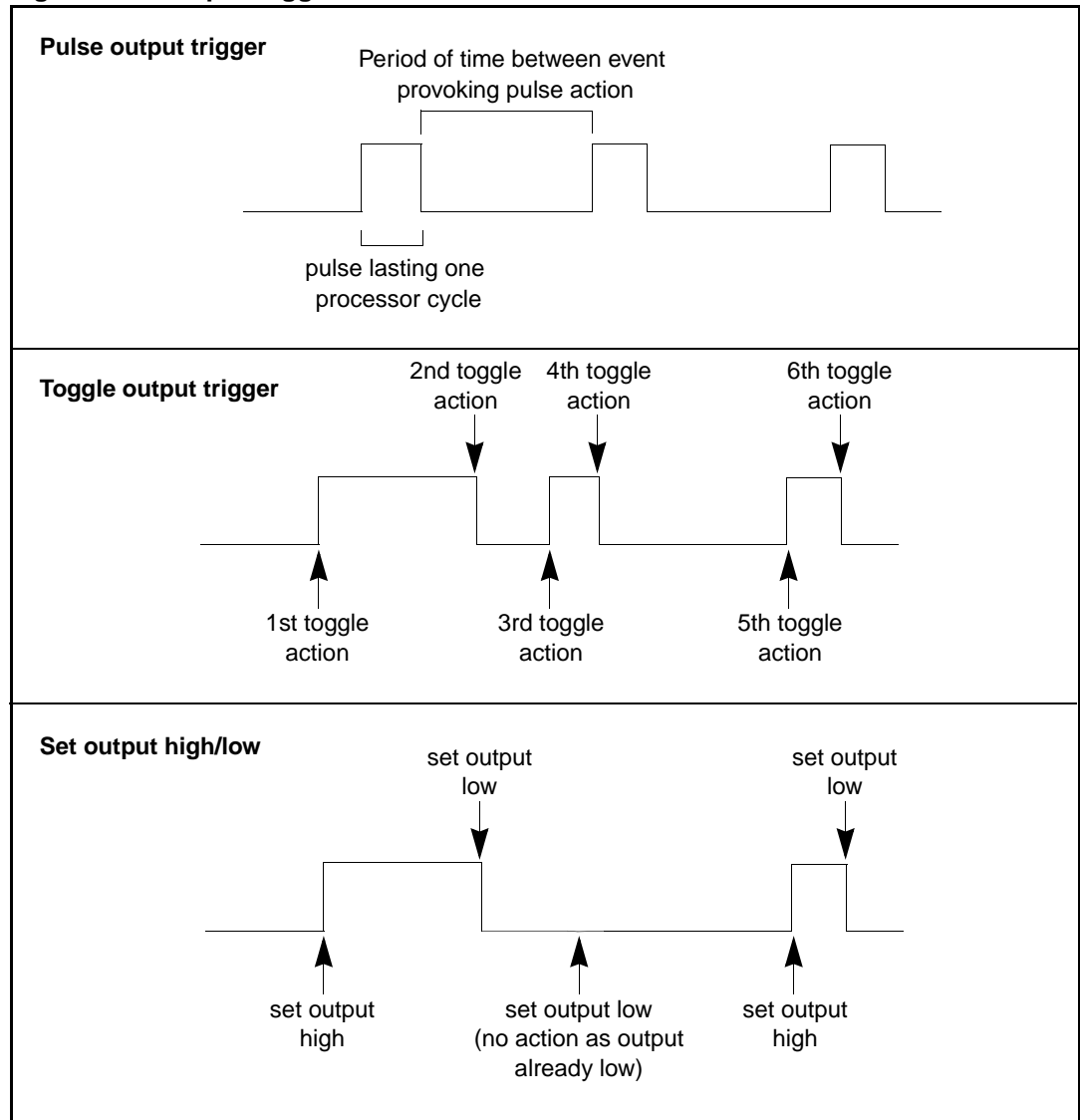
Advanced Breakpoints in STVD7, allow you to define an event based on input signals (see also [Section 4.4.3](#) on page 22), and program signals to the output triggers.

The following trigger output modes (schematically represented in [Figure 20](#)) are supported:

- **Output a pulse**—where a signal of value 1 is sent during exactly one memory cycle.
- **Toggle**—where the signal value is changed from 0 to 1 or from 1 to 0.
- **Set the output high**—where the output signal is set equal to 1.
- **Set the output low**—where the output signal is set equal to 0.

Several examples of how to program Advanced Breakpoints to control the sending of signals to the output triggers are given in STVD7's online help and user manual.

Figure 20. Output trigger action modes



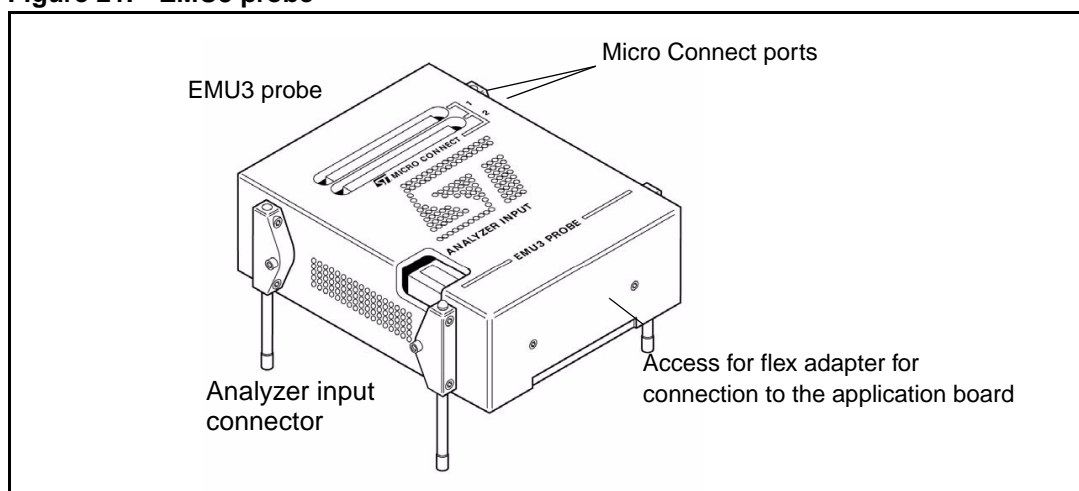
4.4 EMU3 probe

The EMU3 probe ([Figure 21](#)) has a modular design that allows you to emulate the full range of ST7. This design is based on:

1. an interchangeable, target emulation board (TEB) that is specific to the ST7 or family of ST7s that you want to emulate.
2. a common emulation board (CEB) and a dedicated emulation board (DEB) that are common to all ST7. The TEB connects to the DEB, which is housed in your EMU3 probe.

The probe connects to your application board during emulation via a flex adapter and socket. In addition, an analyzer input connector allows the connection of external devices, or input signals from your application hardware. More information about these connections is provided in the *ST7xxx-EMU3 Probe User Guide*.

Figure 21. EMU3 probe



4.4.1 Target emulation board (TEB)

To reconfigure your EMU3 probe to emulate another ST7 or family of ST7s, simply install the appropriate target emulation board (TEB) in the EMU3 probe. TEBs can be ordered independently. For information about the TEB to choose, refer to the *ST Product and Tool Selection Guide*. Installing and changing the TEB is described in detail in the *ST7xxx-EMU3 Probe User Guide* provided with your probe.

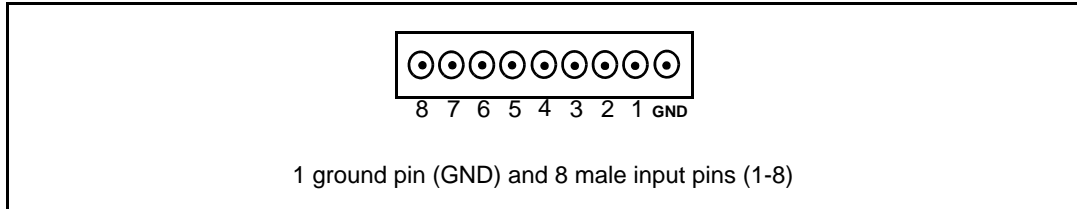
4.4.2 Application board connectors

Connectors on the TEB allow you to connect your probe to your application board, using the appropriate flex adapter and socket. How you connect your EMU3 probe to your application board depends on the ST7 and its package. Different application connectors are provided with your emulator, depending on the MCUs supported by its probe. For a list of connectors provided with your probe and detailed installation instructions, refer to the *ST7xxx-EMU3 Probe User Guide* provided with your probe.

4.4.3 Analyzer input connector

An analyzer input connector is located on the EMU3 probe as shown in [Figure 21](#). The analyzer input connector allows you to use 8 external input signals (TTL level). The connector has nine pins—one ground pin (the right-most pin) and eight input signal pins (1-8), as shown in [Figure 22](#).

Figure 22. Analyzer probe input connections



A specially-adapted 9-wire cable is included to connect your application or an external device (such as an oscilloscope or multi-meter) to these inlets. Each wire is color-coded as summarized in [Table 2](#):

Table 2. Analyzer input pin-wire correspondence

Analyzer input pin	Wire color
Ground (GND)	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Grey

4.4.4 Application power supply follower

Your emulator is equipped with an automatic power supply follower, which converts your application power to the range supported by the emulator. The emulator's internal power supply regulator supports a V_{DD} voltage up to 5.5 V. The lower limit of the range depends on the ST7 you are emulating. For more information, refer to your ST7xxxx Datasheet.

If your application's voltage lies outside of the range supported by your emulator or your ST7, the emulator's power supply follower will convert the voltage to within the appropriate range – for example, even if the application voltage is 6 V, it will be limited by the emulator to 5.5 V.

4.5 Sharing ST Micro Connect with EMU3 probe and ICC Add-on

Your ST Micro Connect box is the main component for using both the EMU3 probe for emulation and the ICC Add-on for in-circuit communication.

You can use the same ST Micro Connect box in both cases if you follow these guidelines:

- Use only one connection at a time, either the EMU3 probe or ICC add-on connection.
- When switching from the EMU3 probe to the ICC Add-on, follow the procedure below.

Switching from EMU3 probe configuration to ICC Add-on configuration:

1. Switch off the application board.
2. Switch off the ST Micro Connect box.
3. Disconnect the EMU3 probe from the application board socket.
4. Place your ST7 in its socket on the application board.
5. Plug the ICC cable into the HE10 connector on your application board.
6. Switch on the ST Micro Connect box.
7. Switch on the application board.

4.6 Automatic firmware updates

The ST Micro Connect box and EMU3 probe have been designed so that their respective firmware is updated automatically. Your emulator firmware may require updating if you have changed the TEB or if you update your version of STVD7. The update is done automatically if you start a debugging session and STVD7 detects an old firmware version. For more information refer to the *STVD7 User Manual*.

4.7 Emulator functional limitations and discrepancies

4.7.1 Voltage limitation for I²C peripheral

For all target ST7s, if the I²C peripheral is used, you must limit the pull-up resistor to 1.5 kOhms.

4.7.2 Memory emulation limitation

The memory zones listed below can only be configured as RAM, ROM, Non-existent memory (NEM), vectors or stack.

- from 0x00E0 to 0x00FF
- from 0xEBE0 to 0xFFE0

4.7.3 Limitations and discrepancies for specific MCUs or families of MCUs

Specific MCUs or families of MCUs may be subject to emulation limitations or discrepancies. You will find information about these specific limitations in STVD7's **Discrepancies** window. For more information refer to the *STVD7 User Manual*.

5 In-circuit communication configuration

In the in-circuit communication configuration, the ST7-EMU3 emulator provides the capability to program your application to your microcontroller and to debug your application as it runs on your ST7. The following sections provide information about:

- [Section 5.1](#) – the system architecture
- [Section 5.2](#) – ICC connection requirements
- [Section 5.3](#) – ICC Add-on features
- [Section 5.4](#) – the ST Micro Connect boxes' dual configuration capability

5.1 System architecture and development features

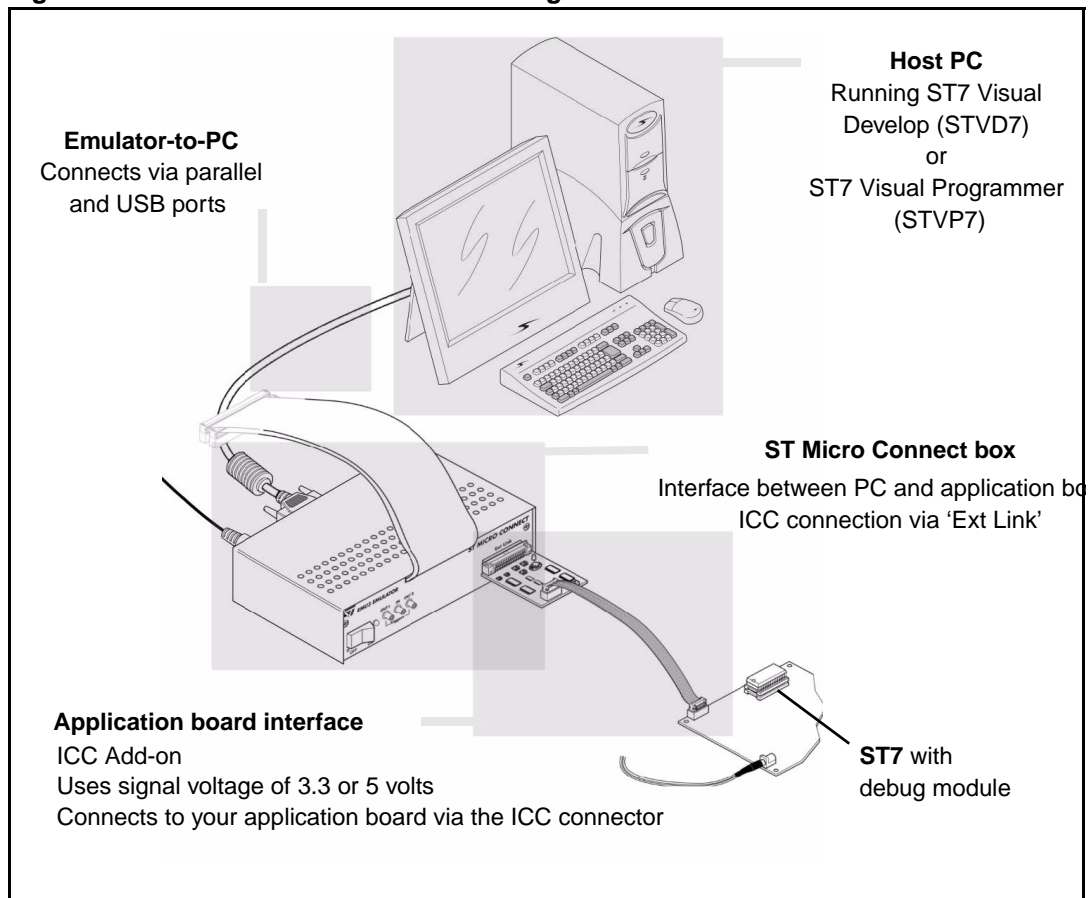
The ST7-EMU3 emulator comes with an in-circuit communication (ICC) Add-on. This connection device allows users to take advantage of the ICC protocol for in-circuit programming (ICP) and debugging (ICD) on ST7s with XFLASH or HDFLASH memory. In conjunction with ST7 Visual Programmer (STVP7) and ST7 Visual Develop (STVD7) software, this device makes it possible to program your application software to the ST7 on your application board and then debug your application while it runs on your ST7 (see [Figure 23](#)).

In the in-circuit communication configuration, the ICC Add-on serves as the hardware interface for connecting your ST Micro Connect box to the ST7 on your application board.

During application development, STVD7 software running on your PC provides an integrated development environment that allows you to debug your application while it runs on an ST7 that has debug modules. STVD7's in-circuit debugging features include advanced breakpoints, as well as trace recording for MCUs with a memory trace controller (MTC) module. For more information about in-circuit debugging with STVD7, refer to the *STVD7 User Manual* provided with your software package.

Once you have finalized your application, STVP7 software provides a graphical interface for verifying memory sectors, checking the settings of the option bytes and programming the MCU. For more information about programming with STVP7, refer to the STVP7 online help provided with your software package.

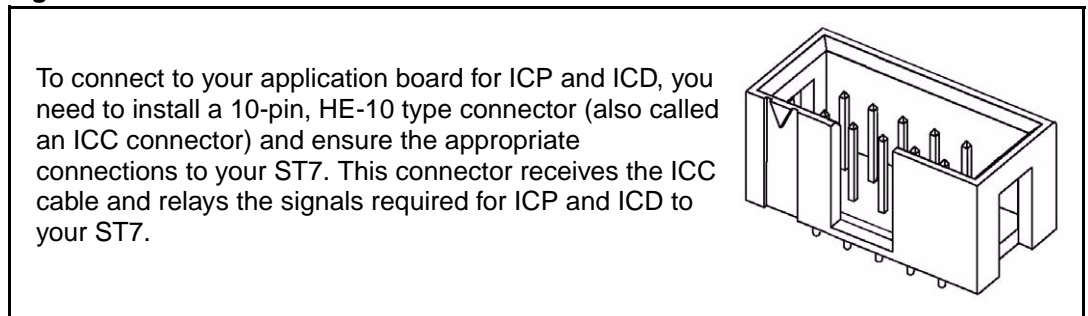
Figure 23. In-circuit communication configuration



5.2 ICC connection requirements

To take advantage of ICC, you must integrate an ICC connector into your application hardware when you start developing your application. To help you implement ICP and ICD in the development of your application, this section provides a summary of points you should consider when installing an ICC connector.

Figure 24. In-circuit communication connector



Using the ICC protocol requires that a minimum of 4 and as many as 6 pins of your ST7 be relayed to the ICC connector. These connection requirements are illustrated in [Figure 25](#), below and summarized in [Figure 4](#).

Figure 25. ICC interface

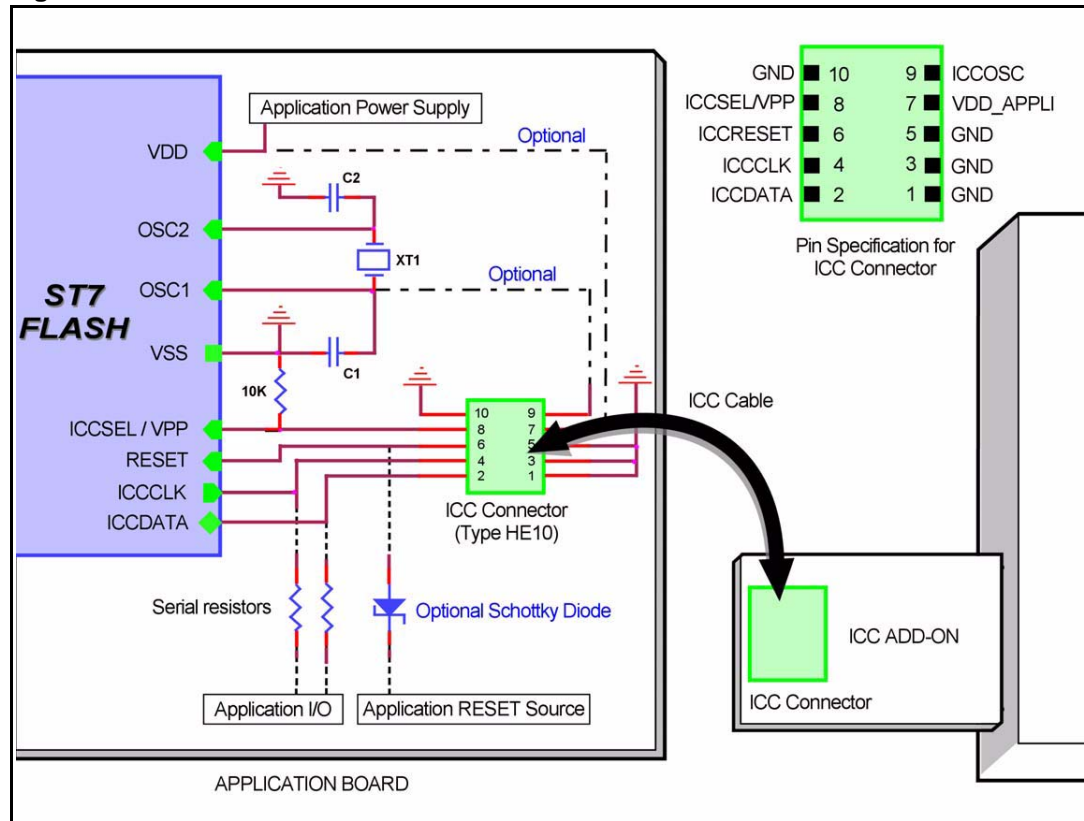


Table 3. ICC connection requirements

ST7 pin	Description	Connects to ICC
ICCDATA	ICC input/output serial data pin	ICCDATA
ICCCLK	ICC output serial clock pin	ICCCLK
RESET	Device reset	ICCRESET
ICCSEL/VPP	Programming voltage	ICCSEL/VPP
OSC1 or OSCIN	Main clock input for external	ICCOSC
VDD	Device power supply	Not connected
VSS	Device power supply (ground)	GND

Isolation of ICCDATA and ICCCLK pins

As soon as the emulator's ICC Add-on is plugged into the application board the ICCDATA and ICCCLK pins must not be used by other application devices, even if an ICC session is not in progress. If the application uses these pins as inputs, isolation such as a serial resistor must be implemented to prevent other application devices from forcing a signal on either of these pins. The application board must not drive current in excess of 1mA. If the ICCDATA and ICCCLK pins are only used as outputs by the application, no signal isolation is necessary. For ST7 without an ICCSEL pin, during normal operation the ICCCLK pin must be pulled-up internally or externally (10KΩ pull-up required in noisy environments). This is to avoid entering ICC mode unintentionally during a reset.

Isolation of the RESET pin

During an ICC session, you must ensure that the emulator controls the ST7's RESET pin so that no external reset is generated by the application. This can lead to a conflict if the application reset circuitry signal exceeds 5mA (push-pull output or pull-up resistor <1k). To avoid such conflicts, a Shottky diode can be used to isolate the application reset circuit.

ICCSEL/VPP pin

The application pull-down resistor must not be lower than 10 kΩ

ICCOSC pin

The ICCOSC pin of the ICC connector must be connected to the ST7's OSC1 or OSCIN pin if the clock is not provided by the application, or if the application clock source is not programmed in the option byte. This connection allows you to start your ICP session using the **ICP OPT Disable** mode when programming, or the **Start with External Clock (Ignore Option Bytes)** feature when debugging. In this case, the ICC Add-on provides a clock source to initiate communication with the ST7. Your emulator with ICC Add-on provides a clock source at a frequency of 8 MHz.

For ST7 devices with multi-oscillator capability, when the ICCOSC pin is connected, the OSC2 pin should be grounded.

If your application provides a clock signal and you are certain that it is programmed in the ST7's option byte, you can start your ICP session using the **ICP OPT Enable** mode and when starting your ICD session it is not necessary to use the **Start with External Clock (Ignore Option Bytes)** feature in STVD7. In this case, your application clock source provides the clock signal for initiating communication with your ST7 and ICCOSC is not connected to your ST7.

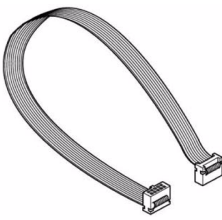
VDD_APPLI pin

Not connected as EMU3 emulator's power supply follower is not used with the ICC Add-on.

ICC cable

Your EMU3 emulator includes a 30cm long ICC cable for connecting to the ICC connector on your application board. You can use a cable up to 2 meters long.

Table 4. Typical ICC cable characteristics

Characteristic	Typical measurement	ICC cable image
Pitch	1.27 mm	
Section	0.09 mm ²	
Impedance	100 Ohms	
Nominal Voltage	300 V	
Max. Current	1 A	
Temperature	-10°C to +105° C	

5.3 ICC Add-on

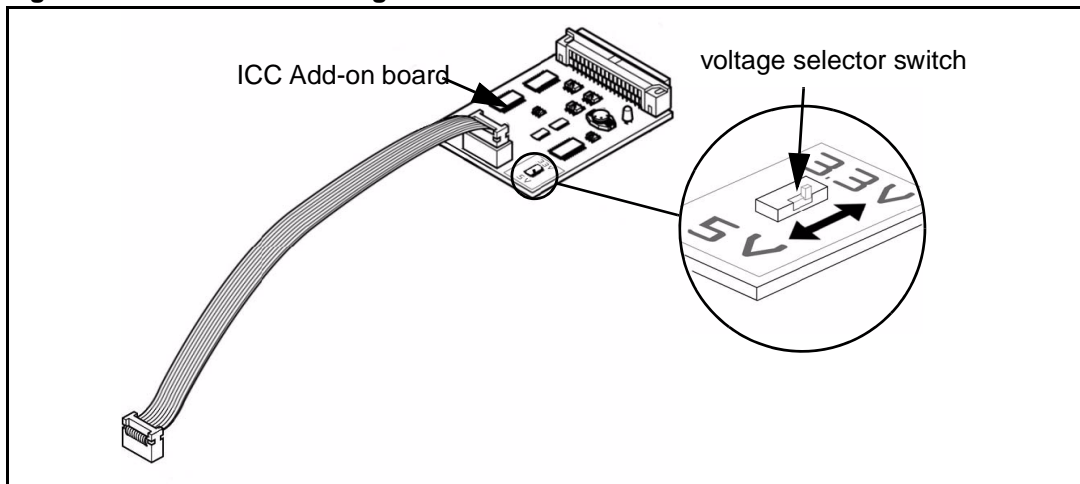
The ICC Add-on is the hardware link between your ST Micro Connect box and the the ST7 on your application board. It connects to the ST Micro Connect box via the 26-pin 'Ext Link' connection on the front panel, and plugs directly into your application board by way of a standard HE10 connector.

5.3.1 Voltage selector

You have designed your application to use either 3.3 or 5 V as the signal voltage for your ICC Add-on. The voltage selector switch on the ICC Add-on must be set to the voltage you selected when designing your application. The selector switch is located on the top of the ICC Add-on's board (see [Figure 26](#)).

Set the voltage of the ICC Add-on by switching the voltage selector switch to the appropriate voltage as shown in [Figure 26](#), below:

Figure 26. ICC Add-on voltage selector switch



5.4 Sharing ST Micro Connect with ICC Add-on and EMU3 probe

Your ST Micro Connect box is the main component for using both the ICC Add-on for in-circuit communication and the ST7-EMU3 series probes for emulation.

You can use the same ST Micro Connect box in both cases if you follow these guidelines:

- Only use one connection at a time, either the ICC Add-on or the EMU3 probe.
- When switching from the ICC Add-on to the EMU3 probe, follow the procedure below.

Switching from ICC Add-on configuration to EMU3 probe configuration

1. Switch off the application board.
2. Switch off the ST Micro Connect box.
3. Unplug the ICC cable from the HE10 connector on your application board.
4. Remove the ST7 and connect the EMU3 probe to the application board socket.
5. Switch on the ST Micro Connect box.
6. Switch on the application board.

Appendix A EMC conformity and safety requirements

Warning: This product conforms with the 89/336/EEC Directive. It complies with the ITE EN55022 standard for EMC emissions and generic 50082-1 (1992 edition) immunity standards.

This product is an FCC Class-A apparatus. In a residential environment, it may cause radioelectrical disturbances.

Use in life support devices or systems must be expressly authorized.

STMicroelectronics products are not authorized for use as critical components in life support devices or systems without the express written approval of STMicroelectronics. As used herein:

1. Life support devices or systems are those which (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided with the product, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can reasonably be expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

This product respects the EMC requirements of the European guideline 89/336/ EEC under the following conditions:

- Any tester, equipment, or tool used at any production step, or for any manipulation of semiconductor devices, must have its shield connected to ground.
- All provided ferrites must be attached as described in the hardware installation instructions of the relevant user manual(s).
- The product must be placed on a conductive table top, made of steel or clean aluminum, grounded through a ground cable. Before every contact with the emulator, the operator must touch the surface of the grounded worktable just behind the rear panel of the ST Micro Connect box. All manipulation of finished must be done at such a grounded worktable.
- The worktable must be free of all non-antistatic plastic objects.
- It is recommended that you wear an antistatic wrist or ankle strap, connected to the antistatic floor covering or to the grounded equipment.
- If no antistatic wrist or ankle strap is worn, before each manipulation of the powered-on tool, you must touch the surface of the grounded worktable just behind the rear panel of the ST Micro Connect box.
- It is recommended that antistatic gloves or finger coats be worn.
- It is recommended that nylon clothing be avoided while performing any manipulation of parts.

Appendix B Troubleshooting

The following table gives a list of error messages that may occur when using STVD7 and your EMU3 Emulator. If the instructions in this table don't resolve the problem, contact STMicroelectronics Product Support (see [page 36](#)). Detailed error messages are logged in `Err.log`—your STMicroelectronics support representative may ask you to send this file in order to resolve the problem quickly.

Table 5. Error messages

If the following error occurs:	Then...
Error 10025 Emulator initialization error	This error occurs when one of the software files needed by STVD7 in order to initialize the emulator is missing or damaged. Check that: <ul style="list-style-type: none"> ● STVD7 has been properly installed—re-install STVD7 if in doubt. ● Any necessary firmware upgrades have been performed—see Section 4.6 on page 23. If this error persists, contact STMicroelectronics Product Support.
Error 20004 Communication initialization error	This error only occurs when STVD7 cannot initialize the emulator during startup (when you click the Debug button to load your application into the emulator). Ensure that: <ul style="list-style-type: none"> ● The parallel cable is connected between the ST Micro Connect box and to the PC parallel port (LPT1 or LPT2) that you specified when installing STVD7. ● You have not placed any switch boxes between the parallel port connector of your PC and the ST Micro Connect box. ● The ST Micro Connect box is powered on. ● The parallel cable used is the one supplied with the by STMicroelectronics. If none of the above items has been overlooked, this may mean that your parallel port connection needs to be reconfigured. Please refer to Section 3.1.2 on page 10 .
Error 20013 Communication error	This means that the communication link between STVD7 and your emulator has been broken while STVD7 has been in use. Check that: <ul style="list-style-type: none"> ● The parallel cable is connected between the ST Micro Connect box and one of the PC's parallel ports (LPT1 or LPT2). Note that the use of switch boxes between the parallel port connector of your PC and the ST Micro Connect box is not recommended. ● The ST Micro Connect box is powered on.

Table 5. Error messages (continued)

If the following error occurs:	Then...
<p>Error 30103 The required EMU3 emulator is already in use by another process.</p>	<p>This error occurs if STVD7 tries to initialize a new debugging session with the emulator while it is running another application.</p> <p>This scenario could occur in two ways:</p> <ul style="list-style-type: none"> ● If you exit STVD7 and the emulator running an application (i.e. if you perform a Stop Debug command while the application is running, a dialog box will appear giving you the option to exit STVD7 while leaving the application running on the emulator). If you still want to initialize a new debugging session with STVD7, you must stop the application running on the emulator by performing a hard reset (ON/OFF) on the ST Micro Connect box. ● The emulator is shared by several users on a network, and is in use by another user.
<p>Error 40805 Failure when setting required clock.</p>	<p>You have selected an external clock frequency which is outside of the supported range. Please refer to your <i>ST7xxx-EMU3 Probe User Guide</i> for a listing of supported external clock frequencies.</p>
<p>Error 40806 Required clock is not active and cannot be selected (example - no signal on external clock)</p>	<p>You have selected the external clock option, but there is no external clock signal being received. Check that:</p> <ul style="list-style-type: none"> ● You have connected an external clock to your application board. ● You have turned on the power source to the external clock.
<p>Error 41001 EMU3 Probe (or one of its boards) is not properly connected. Verify all connections between ST Micro Connect box and TEB.</p>	<p>This error means that ST Micro Connect cannot communicate with the emulation hardware in the EMU3 probe. Ensure that:</p> <ul style="list-style-type: none"> ● The flat cables linking the EMU3 probe and the ST Micro Connect box are properly connected (i.e. not twisted or disconnected). ● There is an EMU3 TEB installed in the EMU3 probe. See your <i>ST7xxx-EMU3 Probe User Guide</i> for more information on removing and installing TEBs in the EMU3 probe.
<p>Error 41103 Emulation hardware not recognized or bad connection between ST Micro Connect and EMU3 probe.</p>	<p>This error arises when there is a communication problem with the CEB board in the EMU3 Probe. Ensure that the flat cables between the ST Micro Connect box and the EMU3 probe are not reversed—see Section 4.3.2 on page 18 for more information.</p> <p>This error can also occur if your emulation hardware (for example, the TEB) is more recent than the version of STVD7 installed on your PC.</p> <p>Ensure that if you install a new TEB, you have reinstalled the version of STVD7 delivered on the <i>Microcontroller Development Tools</i> provided with the TEB. Note that all versions of STVD7 are backwards compatible, and therefore, updating versions will not cause any incompatibility with older hardware.</p>
<p>Error 41104 Emulation hardware not recognized or probe internal communication error.</p>	<p>This error means that there is a problem with one of the probe boards, the DEB. The problem may be due to one of the following:</p> <ul style="list-style-type: none"> ● The connection between the CEB and DEB is faulty. ● There is a fault in the DEB board itself. <p>To resolve this error, contact STMicroelectronics Product Support.</p>

Appendix C Glossary

CEB (Common emulation board)

One of three boards that make up the EMU3 probe. It provides the link between the probe and the ST Micro Connect box, and is common to all EMU3 probes.

DEB (Dedicated emulation board)

One of three boards that make up the EMU3 probe. The DEB is specific to ST7. This board provides the link between the TEB and the CEB.

Debug module

An ST7 hardware peripheral that is able to manage instruction stepping, complex breakpoints and abort for in-circuit debugging.

DIL (Dual In-line)

A type of device package with two rows of pins for thru-hole mounting. Sometimes also called DIP (Dual In-line Package).

ECP (Extended capabilities port communication standard)

A parallel-port standard that supports bi-directional communication between a PC and a peripheral device.

EEPROM (Electrically erasable programmable read-only memory)

A non-volatile type of memory that can be erased and reprogrammed by program instructions. Since no special power supplies or ultra-violet light source is needed, the contents of this kind of memory can be changed without removing the MCU from the application system.

EPP (Enhanced parallel port communication standard)

A parallel port standard that supports bi-directional communication between a PC and a peripheral device other than a printer.

EPROM (Erasable programmable read-only memory)

A non-volatile type of memory that can be erased by exposure to an ultra-violet light source. MCUs that have EPROM are easily recognized because the package has a quartz window to allow exposure to the UV light. If the EPROM MCU is packaged in an opaque plastic package, it is called a "one-time programmable" OTP MCU because there is no way to expose the EPROM to a UV light source.

Footprint

The dimensions of the location of a component on a printed circuit board or in a socket. It depends on the number of pins, their size, type and positioning. The footprint of each ST7 device is specified in the datasheet in the section titled *Package Mechanical Data*. (Refer to the ST7 MCU FAMILY DATABOOK or the datasheets provided on the "Microcontroller Development Tools" CD-ROM).

I²C (Inter-integrated circuit)

A protocol for a bus that can be connected to multiple integrated circuits and that allows any one of them to initiate data transfer.

ICC (In-circuit communication)

A device communication protocol that is stored in the ST7 microcontroller's system memory. This protocol makes it possible to download programs to the MCU's RAM and execute them. This protocol enables in-circuit programming and debugging.

ICC monitor

Software that handles the ICC protocol, embedded in a reserved memory area of the ST7 Flash microcontroller. At RESET, using specific signal sequence, the ST7 jumps to this ICC monitor which allows it to download programs in RAM and to execute them. This feature is used for in-circuit programming and debugging.

ICD (In-circuit debugging)

The capability to debug an application on a FLASH device using on-chip resources (Debug Module, MTC), made possible by the ICC protocol.

ICP (In-circuit programming)

The capability to program to ST7 FLASH memory while the microcontroller is plugged into the application board, made possible by the ICC protocol.

LVD (Low voltage detection)

A feature available on all of the ST7s. A LVD push button allows you to simulate what occurs when the MCU detects that the supply voltage is below a given threshold.

MCU (Microcontroller)

Also referred to as the "target device" in this manual. This is the core product (or family of products) for which the Development is designed to act as an emulator and programming tool. In general terms, an MCU is a complete computer system, including a CPU, memory, a clock oscillator and I/O on a single integrated circuit.

MTC (Memory trace controller)

An ST7 hardware peripheral that allows the user to record hardware cycles in a specified block of memory (buffer) when in-circuit debugging. Allows recording in either circular mode, continuously recording and replacing the oldest record, or linear mode, recording until the buffer is full.

OTP (One time programmable)

Also referred to as OTPROM (one time programmable read-only memory). A non-volatile type of memory that can be programmed but cannot be erased. An OTP ROM is an EPROM MCU that is packaged in an opaque plastic package—it is called a one-time programmable MCU because there is no way to expose the EPROM to a UV light source.

PC (Program counter)

The CPU register that holds the address of the next instruction or operand that the CPU will use.

PLD (Programmable logic device)

An integrated circuit that can be programmed to perform complex functions.

PQFP (Plastic quad flat package)

A family of integrated circuit packages for surface mounted assembly. This type is packaged with plastic, has a square flat shape and pins on all four sides.

RC network (Resistor-capacitor network)

A combination of resistors and capacitors in a circuit that are typically used to control or minimize voltage spikes.

Read/Write on the fly

A feature that allows you to perform a non-intrusive read or write of a variable during emulation (i.e. while program running). The variable may be 8, 16 or 32 bits in size and can be located anywhere in the emulation memory (up to 64 kilobytes) except for the hardware register (peripherals) and internal system (A, X, Y, PC, CC and SP). The *Read/Write on the fly* option is available in both the Memory window and Watch window of STVD7.

SDIP (Shrink dual in-line package)

A type of device package with two rows of pins for thru-hole mounting.

SO (Small outline)

A type of device package with two rows of pins for SMD or socket mounting.

STVD7 (ST7 visual develop)

A software package that allows you to debug applications destined for the ST7 family of MCUs, either using a built-in simulator function, a development or an emulator.

STVP7 (ST7 visual programmer)

A software application that allows you to program ICC-enabled microcontrollers using an ICC link for an emulator or a development.

Target device

The ST7 devices that you have chosen for your application microcontroller and that you will emulate or program.

TEB (Target emulation board)

A target emulation board for the EMU3 series of emulators. A printed board having connector pins that, when plugged into the dedicated emulation board (DEB) of the EMU3 probe, allows you to connect the EMU3 probe to the MCU socket of the user application board.

TQFP (Thin quad flat package)

A family of integrated circuit packages for surface mounted assembly. This type of package has a square, flat shape and pins on all four sides.

TTL (Transistor to transistor logic)

A bipolar technology where a transistor output is connected directly to the transistor input of the next stage, rather than connecting through a resistor or diode.

User application board

Your application board, which includes a connector for the ST7 device you have chosen to use.

Appendix D Product support

If you experience any problems with this product, or if you need spare parts or repairs, contact the distributor or the STMicroelectronics sales office where you purchased the product. Phone numbers for major sales regions are provided on the www.st.com web site.

From the www.st.com site, select **Products > Microcontrollers** to obtain a complete online selection guide, as well as documentation, software downloads and user discussion groups to help you answer questions and stay up to date with our latest product developments.

D.1 Software updates

All our latest software and related documentation are available for download from the STMicroelectronics internet site, www.st.com.

If you are using software from a third-party tool provider, please refer to the third-party for software product support and downloads.

D.2 Hardware spare parts

Your development tool comes with the hardware you need to set it up, connect it to your PC and connect to your application. However, some components can be bought separately if you need additional ones. You can order extra components, such as sockets and adapters, from STMicroelectronics, from the component manufacturer or from a distributor.

To help you find what you need, a listing of accessories for STMicroelectronics development tools is available on the STMicroelectronics internet site, www.st.com.

D.2.1 Sockets

Complete documentation and ordering information for P/TQFP sockets from Yamaichi, Ironwood, CAB and Enplas are provided on their respective internet sites.

D.2.2 Connectors

Complete documentation and ordering information for SAMTEC connectors is provided on their internet site.

D.3 Getting prepared before you call

Collect the following information about the product before contacting STMicroelectronics or your distributor:

1. Name of the company where you purchased the product.
2. Date of purchase.
3. Order code: Refer to the side your emulators box. The order code depends on the region in which it was ordered (i.e. the UK, Continental Europe or the USA).
4. Serial number: The serial number is found located on the rear panel of the ST Micro Connect box and is also listed on the Global Reference card provided with the emulator.
5. TEB (target emulation board) hardware and firmware versions: The hardware and firmware versions can be found by opening an STVD7 session, entering the debug context and selecting **Help > About** from the main menu. The TEB version numbers are given in the *Target box* – scroll downwards until you find the TEB version (hardware) and TEB PLD version (firmware).
6. Target device: The sales type of the ST microcontroller you are using in your application.

Revision history

Table 6. Document revision history

Date	Revision	Description
01-Nov-2002	2.0	<ul style="list-style-type: none">– Added Chapter 2 – Software installation– Added Section 4.11 – Set up instructions for ST Micro Connect
01-Jun-2003	3.0	<ul style="list-style-type: none">– Removed sections containing STVD7 user instructions– Updated Section 1, Section 5 – In-Circuit Programming (ICP)– Changed Section 3 – to connectivity chapter describing configuration of connection to host PC
01-Sep-2003	3.1	<ul style="list-style-type: none">– Updated Section 1, Section 5 – In-Circuit Debugging (ICD)
01-Sep-2004	3.2	<ul style="list-style-type: none">– Added Table 1 – ST7-EMU3 User Manual revision history– Updated Section 3.3 – Ferrite installation for Ethernet– Corrected Section 3.3, Section 2.1 – Serial cable specification– Added Section 5.2 – In-Circuit Communication (ICC) connection requirements
12-Mar-2009	4	<ul style="list-style-type: none">– Revalidated. Reformatted. First Chapter split between cover page and Chapter 1.

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