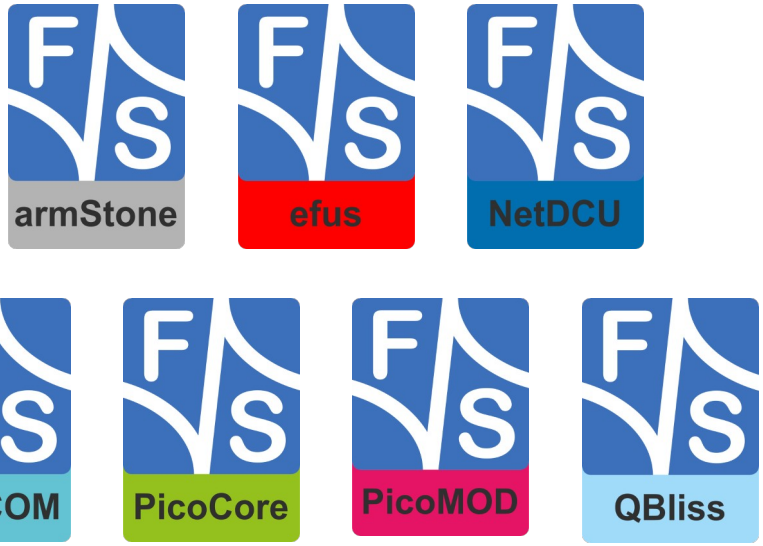
# F&S i.MX8M-Mini Linux

## *First Steps*

Version 1.10
(2026-08-21)

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# About This Document

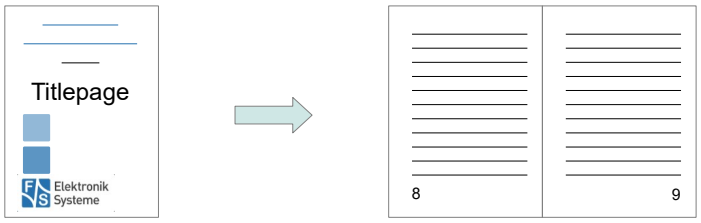
This document shows how to bring up F&S boards and modules under Linux and how to use the system and the devices. It is intended to help you get to know the board so that you can take the first steps to try out and test all the peripherals.

### Remark

The version number on the title page of this document is the version of the document. It is not related to the version number of any software release! The latest version of this document can always be found at http://www.fs-net.de.

### How To Print This Document

This document is designed to be printed double-sided (front and back) on A4 paper. If you want to read it with a PDF reader program, you should use a two-page layout where the title page is an extra single page. The settings are correct if the page numbers are at the outside of the pages, even pages on the left and odd pages on the right side. If it is reversed, then the title page is handled wrongly and is part of the first double-page instead of a single page.




### Typographical Conventions

We use different fonts and highlighting to emphasize the context of special terms:

`File names`

*Menu entries*

`Board input/output`

`Program code`

`PC input/output`

`Listings`

`Generic input/output`

`Variables`

# History

| Date | V | Platform | A,M,R | Chapter | Description | Au |
|---|---|---|---|---|---|---|
| 2020-05-09 | 1.0 | fsimx8mm | M | ALL | Based on fsimx7ulp V1.2 | AD |
| 2020-08-13 | 1.1 | fsimx8mm | M | 2 | Add description for PicoCoreBBDSI rev. 1.20 | AD |
| 2020-08-18 | 1.2 | fsimx8mm | A, M | 3.1, 5 | Add content of rel. directory to section 3.1, add chapter 5 | AD |
| 2020-10-21 | 1.3 | fsimx8mm | A, M | 3.3 | Add two different ways how to install the system either via F&S install concept or UUU Tool | PJ |
| 2020-11-27 | 1.4 | fsimx8mm | A, M, R | 1.1, 2.1<br>4.16<br>4, 4.7 | Add information about fsimx8mx<br>Remove VNC chapter as it is only for x11<br>Add section about Yocto | PJ |
| 2021-04-23 | 1.5 | fsimx8mm | A, M, R | ALL | Go back to template fsimx6 and rework document. | PJ |
| | | | M | 3 | Drop NBoot references, assume installed U-Boot | HK |
| 2021-06-28 | 1.6 | fsimx8mm | M | 4.12 | Add information about second RTC | PG |
| 2022-08-30 | 1.7 | fsimx8mm | M | 1.1 | Add PicoCoreMX8MMr2 | PG |
| 2023-10-26 | 1.8 | fsimx8mm | M | 4<br>1.1,2.1,3.2 | Remove chapter 4. It can be found in Linux on F&S Boards<br>Update information | PG |
| 2024-10-07 | 1.9 | fsimx8mm | M | 1.1 | Add FS 8MM OSM-SF | KM |
| 2026-08-21 | 1.10 | fsimx8mm | M | 1.1 | Add PicoCoreMX8MMr4 | KM |
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| | |
|---|---|
| V | Version |
| A,M,R | Added, Modified, Removed |
| Au | Author |

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# 1 Introduction

## 1.1 F&S Board Families and CPU Architectures

F&S offers a whole variety of Systems on Module (SOM) and Single Board Computers (SBC). There are different board families that are named NetDCU, PicoMOD, PicoCOM, armStone, QBliss, efus and PicoCore (see Table 1).

| Family | Type | Size |
|---|---|---|
| NetDCU | Single Board Computer | 80 mm x 100 mm |
| PicoMOD | System on Module | 80 mm x 50 mm |
| PicoCOM | System on Module | 40 mm x 50 mm |
| armStone | Single Board Computer | 100 mm x 72 mm (PicoITX) |
| QBliss | System on Module | 70 mm x 70 mm (Qseven) |
| efus | System on Module | 62 mm x 47 mm |
| PicoCore | System on Module | 40 mm x 35 mm |
| OSM | System on Module | 30 mm x 30 mm |

*Table 1: F&S Board Families*

Linux is available for all of these platforms. F&S combines releases for platforms with the same CPU – or rather SoC (System on Chip) – as so-called *architecture releases*. All the boards of the same architecture can use the same sources, and the binaries can be used on any board of this architecture. Please note the difference: *board families* are grouped by form factor, *architectures* are grouped by CPU type, i.e. they usually contain boards of different families.

Table 2 shows all the architectures that are currently supported by F&S.

| Architecture | CPU | Platforms |
|---|---|---|
| fsvybrid | NXP Vybrid VF6xx | PicoCOMA5, NetDCUA5, armStoneA5, PicoMOD1.2 |
| fsimx6 | NXP i.MX6 | efusA9, QBlissA9, QBlissA9r2, armStoneA9, armStoneA9r2, PicoMODA9, NetDCUA9 |
| fsimx6sx | NXP i.MX6-SoloX | efusA9X, PicoCOMA9X, PicoCoreMX6SX |
| fsimx6ul | NXP i.MX6-UL/ULL | efusA7UL, PicoCOM1.2, PicoCoreMX6UL |
| fsimx7ulp | NXP i.MX7ULP | PicoCoreMX7ULP |
| fsimx8mm | NXP i.MX8M-Mini | PicoCoreMX8MM, PicoCoreMX8MMr2, FS 8MM OSM-SF, PicoCoreMX8MMr4 |
| fsimx8mp | NXP i.MX8MP | PicoCoreMX8MP(r2), armStoneMX8MP, efusMX8MP |

*Table 2: F&S Architectures*

**Remark**

In December 2015, the two companies Freescale and NXP merged and both companies are now working under the brand name NXP. The name Freescale will disappear in the future, which is why we only use “NXP” throughout this document now. However some programs still output “Freescale” at some places. We have not touched this output to reflect the situation as it is.

## 1.2 Scope of This Document

This document describes the *fsimx8mm* architecture. That means all F&S boards and modules based on the NXP i.MX8M-Mini SoC. The steps in this document will help you getting to know your board and do some basic operations in Linux, so that you can try out all the periphery and do some first tests and comparisons.

The additional document `LinuxOnFSBoards_eng.pdf` explains the more generic ideas and concepts of Linux on F&S boards and modules. So after having become acquainted with the board, you should continue reading this Linux document to get a more in-depth knowledge of the board and software.

# 2 Setting up the Board

In this chapter we will show how to connect the board to the PC. For a first test of the board functions, we only need a serial connection between PC and board. So as a first step, we will introduce all the boards and Starterkits of the *fsimx8mm* architecture and show the location of all connectors, especially the debug port.

## 2.1 Locating the Connectors on the Starterkit

### 2.1.1 PicoCoreMX8MM

The Starterkit includes all components that are required for an initial setup. This includes:

- Cables (ethernet, serial, power, USB, …).
- Software (source, binaries, install scripts, examples).
- Starterkit carrier board that offers connectivity for most interfaces available in PicoCoreMX8MM.
- PicoCoreMX8MM module.

For basic operation please make sure that the Serial Debug Port and power are connected correctly.

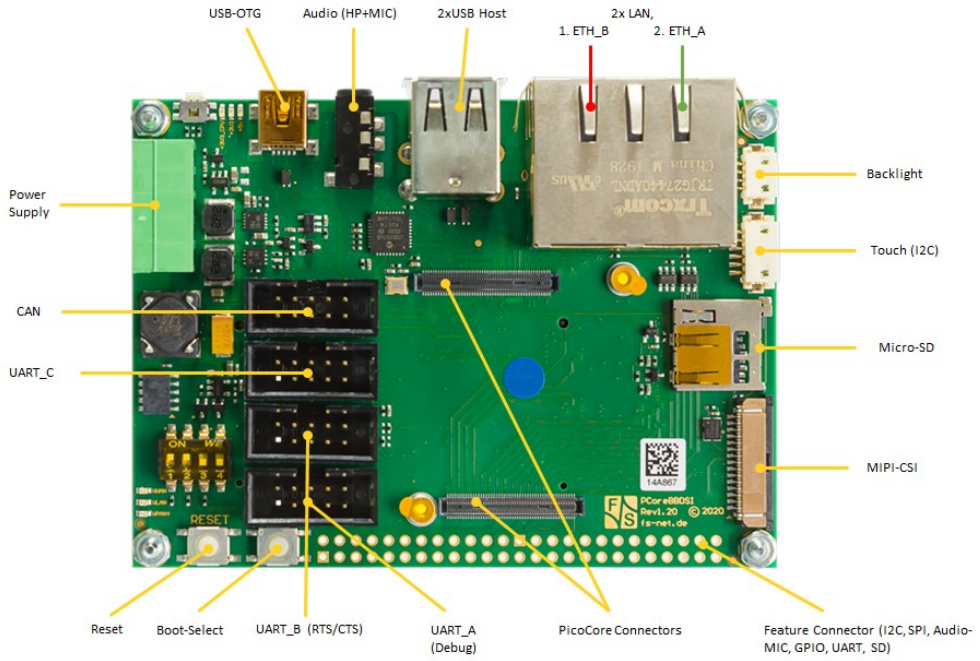


Figure 1: PicoCoreBBDSI Starterkit top (rev. 1.20)

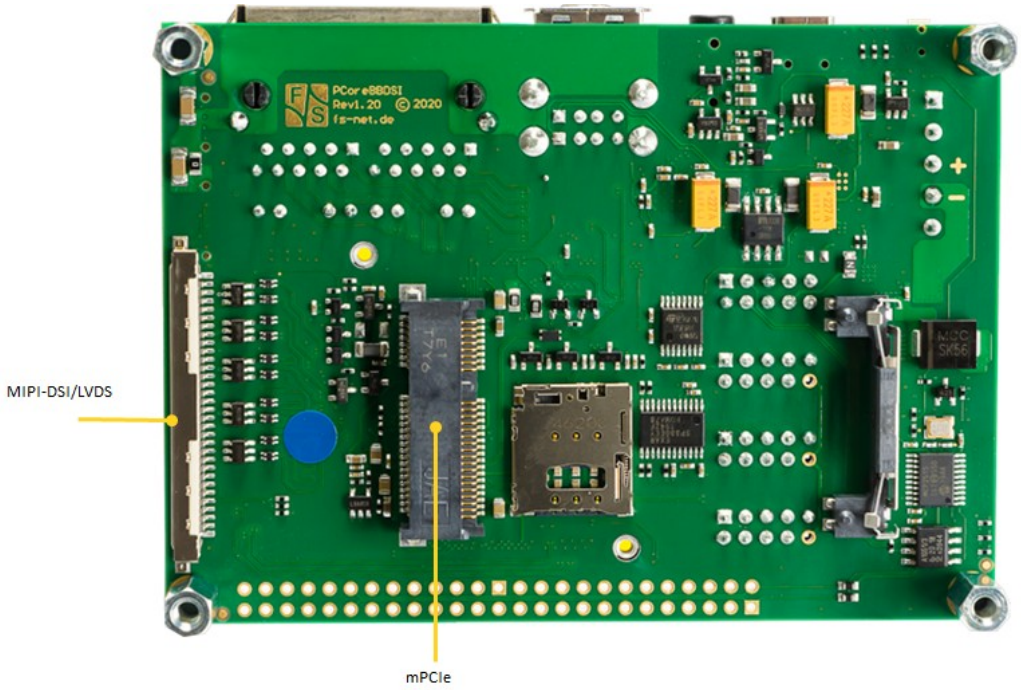


Figure 2: PicoCoreBBDSI Starterkit bot (rev. 1.20)

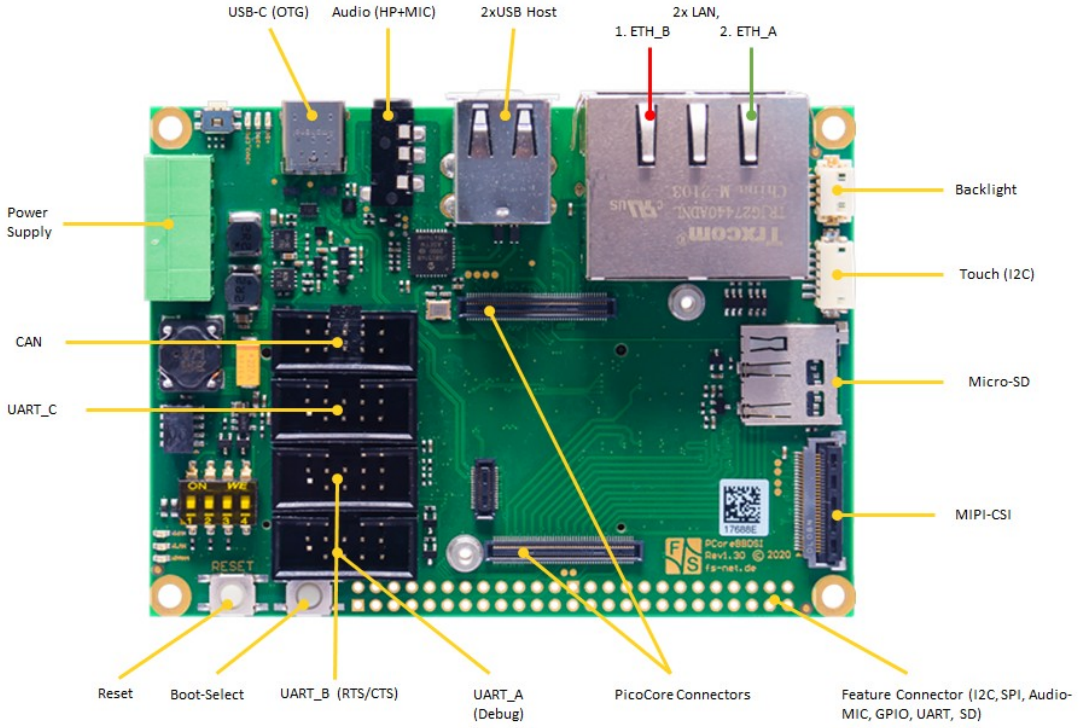


Figure 3: PicoCoreBBDSI Starterkit top (rev. 1.30/140)

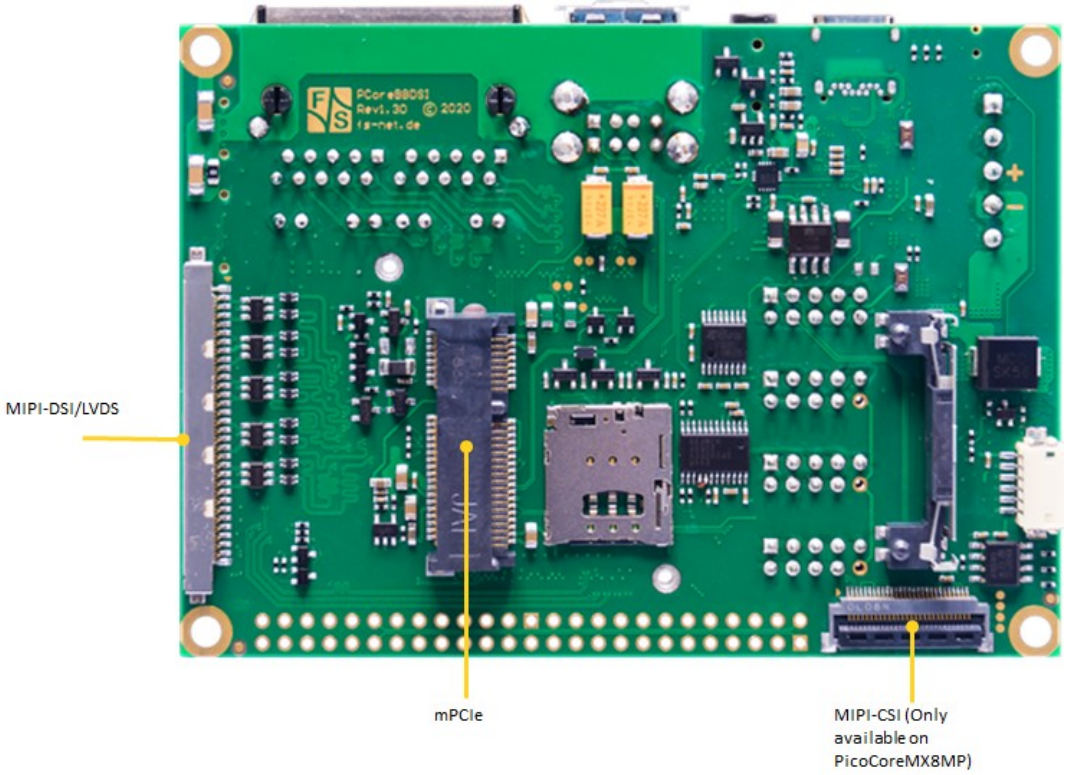


Figure 4: PicoCoreBBDSI Starterkit bot (rev. 1.30/140)

## 2.2 Serial Connection

To work with the board, you need a serial connection with your PC. Use a Null-Modem cable and connect the debug port of the board (or Starterkit baseboard) with the serial port of a PC. Please refer to chapter 2.1 for the location of the COM ports. A serial port is mandatory on your PC, because we control the whole board via the serial port. If your PC does not provide a serial port, you have to either use a USB-to-serial adapter or you need to install a PCIe extension card with a serial port.

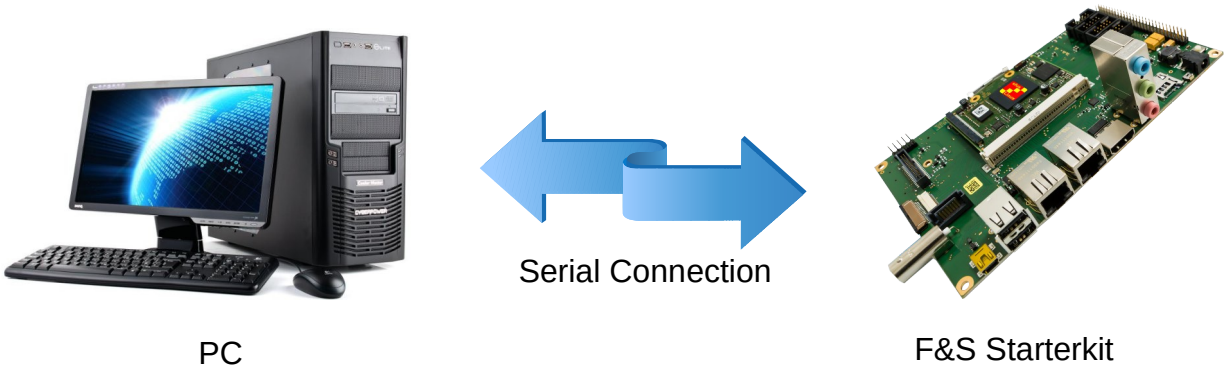


*Figure 5: Serial connection from board to PC*

For a first test, a Linux PC is not necessarily required. You can also use a Windows PC. But later for development, you definitely need a Linux PC. However it is completely sufficient to have a Virtual Linux Machine. So you still can have a Windows based PC and use a Virtual Machine (VM) software like VirtualBox. This combination allows to use software from both worlds, for example have the serial connection done in Windows and only compile the software in the Linux VM.

On your PC, start a terminal program and open a serial connection to the board. Use 115200 baud, 1 start, 1 stop bit, no flow control. We recommend a terminal program that supports a 1:1 binary download and also supports ANSI Escape Sequences for colour and text highlighting. Examples are:

- `TeraTerm` (Windows)
- `PuTTY` (Windows/Linux, does not support 1:1 download)
- `minicom` (Linux, does not support 1:1 download, but not needed in Linux)

F&S also provides a small terminal program for Windows called `DCUTerm`. You can find `DCUTerm` in the Tools-Section of the Download Area (in *My F&S*). However `DCUTerm` does not support ANSI Escape Sequences, which means the output of a Linux command like `ls` is nearly unreadable. Instead of different colours for different file types, you will see a mixture of file names and verbatim escape sequences. Also accessing the command history with the up and down arrow keys is not possible in `DCUTerm`. So `DCUTerm` is not suited very well for Linux. However it supports a 1:1 binary download. So `DCUTerm` is actually a good companion for `PuTTY`. Use `DCUTerm` for serial downloads and `PuTTY` for everything else.

## 2.3 Start Board

Connect a power supply to the board. Please refer to chapter 2.1 for the location of the power supply pins. You need to supply +5V.

Now switch on the power supply. Quite immediately the terminal program should show boot messages from the booting Linux system. This will go on for a few seconds and then a login prompt should appear.

```
Welcome to F+S i.MX8MM
fsimx8mm login:
```

Enter `root` to log in. In the default configuration, no password is required.

If everything went well, you can skip the next chapter and proceed with entering Linux commands.

# 3 Software Installation

When you get a Starterkit from F&S, the Linux system is usually pre-installed and boots to the Linux login prompt right away. In this case you can skip this chapter. But if only U-Boot is installed for some reason (the U-Boot output is shown in Chapter 3.2), the following sections describe how to install the standard Linux software on your platform.

Here we will only show a very simple automatic installation procedure using an SD card or USB stick and some pre-compiled images from the F&S website. This is the easiest way to get to a running system. Of course, there are other ways to install software, for example via network (TFTP). However, this would go beyond the scope of this document.

## 3.1 Download Images From F&S Website

To download any software, go to the F&S main website

https://www.fs-net.de

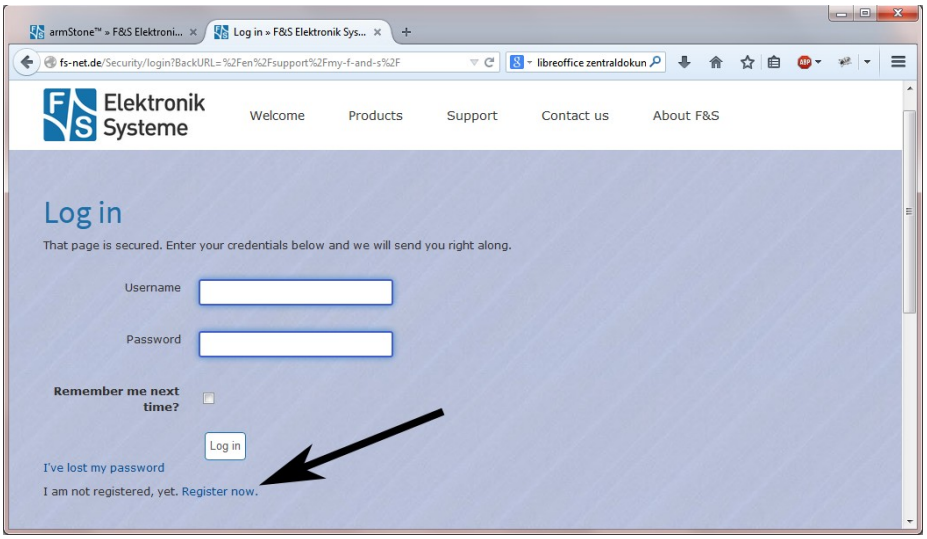


*Figure 6: Register with F&S website*

To download any software, you first have to register with the website. Click on *Login* right at the top of the window and on the text “I am not registered, yet. *Register now*” (Figure 6).

In the screen appearing now, fill in all fields and then click on *Register*. You are now registered and can use the personal features of the website, like the Support Forum and downloading software.

After logging in, you are at your personal page, called “My F&S”. You can always reach this place by selecting *Support* → *My F&S* from the top menu. Here you can find all software downloads that are available for you. In the top sections there are private downloads for you or your company (may be empty) and in the bottom section you will find generic downloads for all registered customers.

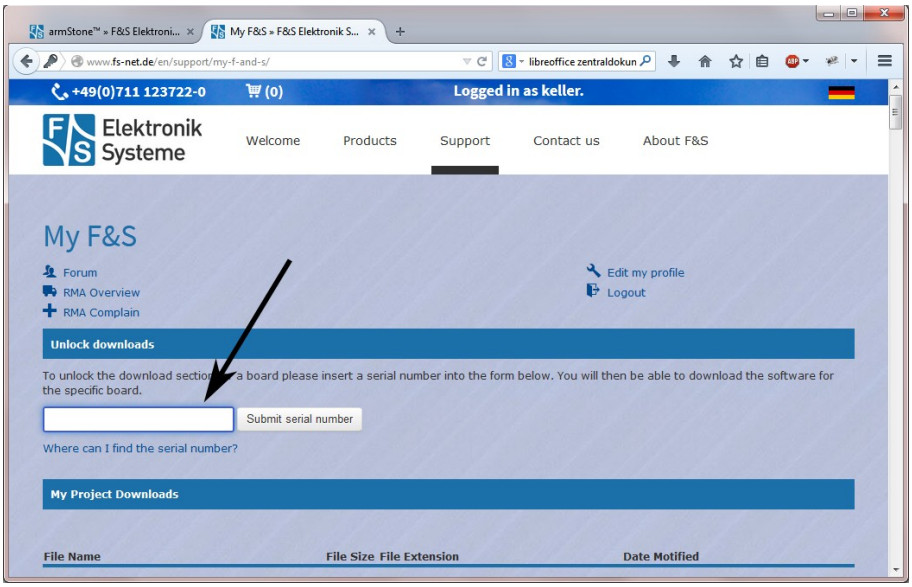


*Figure 7: Unlock software with the serial number*

To get access to the software of a specific board in the bottom section, you have to enter the serial number of one of these boards (see Figure 7). Click on “Where can I find the serial number” to get pictures of examples where to find this number on your product. Enter the number in the white field and press *Submit serial number*. This enables the software section for this board type for you. You will find Linux, Windows CE, and all other software and tools available for this platform like `DCUTerm` or `NetDCUUsbLoader`.

First click on the type of your board, e.g. *PicoCoreMX8MM*, then on *Linux*. Now you have the choice of *Buildroot* or *Yocto*. For the first steps here, we will use the newest Yocto release, because this is the software that is currently also installed on our Starterkits. So click on *Yocto*. This will bring up a list of all our Yocto releases. Old releases up to 2018 had `V<x>.<y>` as version identifier, new releases use `Y<year>.<month>`. We will abbreviate this as `<v>` from now on. Select the newest version, for example `fsimx8mm-Y2021.04`. This will finally show two archives that can be downloaded.

`fsimx8mm-<v>.tar.bz2`.....This is the main release itself containing all sources, the binary images, the documentation and the toolchain.

`sdcard-fsimx8mm-<v>.tar.bz2`. Files that can be stored on an SD Card or USB stick to allow for easy installation.

For now we will only need the SD card archive. This archive contains some pre-compiled images of bootloaders, Linux kernel, device trees and root filesystem. It is compressed with bzip2. To see the files, you first have to unpack the archive, for example in Linux with

```
tar xvf sdcard-fsimx8mm-<v>.tar.bz2
```

This will create a directory `sdcard` that contains all necessary files. Now copy these files to an SD card or USB stick. We will call this the *installation media*. It has to be formatted with the FAT filesystem. Do not create any subdirectories, the files have to reside directly in the top directory of the media.

## 3.2 Install Kernel, Device Tree And Root Filesystem

**Remark**

Boards with i.MX8M-Mini should have at least U-Boot installed. If U-Boot is missing for some reason, it requires a more complicated setup including a USB tool to download some software. This is not handled in this First Steps document.

Insert the installation device into the board or Starterkit baseboard. The remaining installation is fully automatic and is done by U-Boot. Simply switch on the board. This will show something like this:

```
U-Boot SPL 2021.04-nboot-fsimx8mm-2023.10 (Oct 25 2023 - 18:17:38
+0200)
BOARD-ID: PCoreMX8MMr2-FERT4.100


U-Boot 2021.04-F+S-fsimx8mm-Y2023.10 (Oct 25 2023 - 16:07:07
+0000) for F&S

CPU:   i.MX8MMQ rev1.0, 1800 MHz (running at 1200 MHz)
CPU:   Commercial temperature grade (0C to 95C)
Reset: POR
Model: PicoCoreMX8MMr2-LPDDR4
Board: PicoCoreMX8MMr2-LPDDR4 Rev 1.00 (LAN, WLAN, eMMC, 1x DRAM)
DRAM:  1 GiB
TCPC:  Vendor ID [0x1fc9], Product ID [0x5110], Addr [I2C3 0x52]
NAND:  0 MiB
MMC:   FSL_SDHC: 0, FSL_SDHC: 1, FSL_SDHC: 2
Env:   Loading from MMC... OK
In:    serial
Out:   serial
Err:   serial
SEC0:  RNG instantiated
ATF:   fa25831
CFG:   Found at 0x910000
NBoot: 2023.10
Fastb: flash target is MMC:2
Net:   eth0: ethernet@30be0000
Fastb: Normal fastboot
Normal Boot
Hit any key to stop autoboot:  0
```

The number in the last line will count down to zero, then the installation procedure will start. The files are loaded from the installation media and are stored in NAND flash or eMMC flash on the board. When the installation is over, you will see the following line

```
Installation complete

Please set/verify ethernet address(es) now and call saveenv
```

## 3.3 Set MAC Address

When Linux is newly installed, most probably also the U-Boot environment was erased, including the MAC address for the ethernet chip. We have to set it again now and save it permanently.

The MAC address is a unique identifier for a network device. Each network device has its own address that should be unique across the whole world. So each network port on each board needs a unique MAC address.

A MAC address consists of twelve hexadecimal digits (0 to 9 and A to F), that are often grouped in pairs and separated by colons. The first six digits for F&S boards are always the same: 00:05:51, which is the official MAC address code for the F&S company. The remaining six digits can be found on the bar-code sticker directly on your board (see Figure 8).

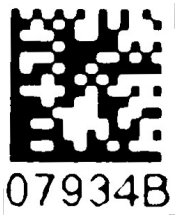


*Figure 8: Bar-code sticker*

The full MAC address for this example would be 00:05:51:07:93:4B.

The following two commands will set the MAC address and stores the current environment (including the newly set MAC address) in NAND flash. Of course you have to replace `xx:yy:zz` with the six hex digits from the bar-code sticker on your board.

```
setenv ethaddr 00:05:51:xx:yy:zz
saveenv
```

**Warning**

If you do not set this unique address, a default address is used that is the same for all boards of this type. This will definitely lead to problems in real networking scenarios.

## 3.4 Restart Board

Installation is complete. To check if everything was done correctly, restart the board. You can either enter U-Boot command

```
reset
```

or press the reset button or simply switch the power off and on again. Like in chapter 2.3, the terminal program should show boot messages from the booting Linux system. This will go on for a few seconds and then a login prompt should appear.

```
Welcome to F+S i.MX8MM
fsimx8mm login:
```

Enter `root` to log in. In the default configuration, no password is required.

If this is still not working, you should repeat the steps from the whole chapter.

# 4 Next Steps

This document only showed a very basic usage of the board and the Linux system. The next logical step is the generic Linux documentation `LinuxOnFSBoards_eng.pdf`. It will show you the ideas and concepts behind the F&S Linux environment and how you can work efficiently with these boards.

## 4.1 F&S Workshops

F&S also offers several workshops. Especially if you are new to working with embedded boards or even new to Linux, we recommend visiting the workshop “Linux on F&S Modules”. Working with an embedded system is quite different to working with a desktop Linux. This workshop will show you a basic introduction to Linux, how to use NBoot, U-Boot and Linux on an F&S board, how to compile the system software, how to download files to the board, and how to write your own programs. The workshop lasts four hours and takes place in Stuttgart at the F&S company building. It may save you many hours of reading, trying, and even frustration.

Additional workshops are available for working with Buildroot, Asymmetric Multiprocessing, Secure Boot, Working with GIT. Please look at our website for any additional offerings.

## 4.2 Further Information

Many additional resources of information are available on the F&S website.

| Document | Description |
|---|---|
| `AdvicesForLinuxOnPC.pdf` | Explains how to install server software and tools on a Linux development PC that is used with F&S Linux boards. |
| `*-GPIO-Reference-Card_eng.pdf` | Lists all pins of the board and which GPIO number needs to be used in Linux |
| `*_Hardware_eng` | Hardware documentation; there are separate documents for each board and also for the Starterkit baseboards. F&S also offers Eagle layout files for some of our Starterkits. |

*Table 3: Important documents, available on the F&S website*

We do not include all these documents in the release to make sure that you always get the newest version when you start. The following sections give direct links to important places like documentation and add-ons.

A good source for information is also our internet forum. If you have any questions or specific problems, please feel free to go to: https://forum.fs-net.de/.

### 4.2.1 PicoCoreMX8MM

Hardware documentation for PicoCoreMX8MM module itself, Starterkit baseboard, including schematics:

https://www.fs-net.de/en/embedded-modules/computer-on-module-picocore/pico-coremx8mm-with-nxp-i-mx8m-mini-processor/#panel-6

Available accessories, adapters and extensions:

https://www.fs-net.de/en/embedded-modules/computer-on-module-picocore/pico-coremx8mm-with-nxp-i-mx8m-mini-processor/#panel-4

# 5 Special Hardware Notes

This chapter lists some supplementary notes that only apply to special hardware configurations based on fsimx8mm. Currently there is no special hardware configuration.

# 6 Appendix

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# Important Notice

The information in this publication has been carefully checked and is believed to be entirely accurate at the time of publication. F&S Elektronik Systeme assumes no responsibility, however, for possible errors or omissions, or for any consequences resulting from the use of the information contained in this documentation.

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