

microCore on the LFXP2_8_Protoboard

To experiment with the prototyping board, **you need:**

1. A 5V Power supply
2. A Lattice JTAG programmer, at least HW-USBN-2A
3. An RS232 serial interface. (Prolific is a lot faster than the ubiquitous FTI based dongles, because of lower delays.)
4. Solder a female DSUB-9 connector to the board as shown in **[./documents/umbilical_adapter.pdf](#)**.
5. A gforth_0.6.2 system as the basis for the uForth cross-compiler. You must have docker installed, which may either run under Linux, MacOS, or Windows10.
`docker pull microcore/gforth_062` will pull a gforth_0.6.2 system into your host.
6. The uCore/uForth codesign environment from git. If you have e.g. github CLI installed, do 'git clone https://github.com/microCore-VHDL/LFXP2_8_protoboard'.
If not, you can download all files as a .ZIP-file. Go to https://github.com/microCore-VHDL/LFXP2_8_protoboard, click on the 'Code' button and select 'Download ZIP'.
7. A Lattice Diamond design environment including the ModelSim simulator, the Synplicity synthesizer, the Lattice place&route and JTAG programmer software from <https://www.latticesemi.com/latticediamond>. When download has finished, click the 'Licensing' button. You receive a free license, which must be renewed every year.

FPGA Configuration

At first, the FPGA has to be configured. Plug the JTAG programmer into the dual row 10 pin connector. Check **[./documents/LFXP2_schematic.pdf](#)** for its pinout.

[./vhd/architecture_pkg.vhd](#) has been set for a 27 bit data width, because that makes optimal use of the 12 RAM blocks that are available on the LFXP2-8 FPGA. Therefore, the FPGA has to be configured using **[./lattice/XP2_8_2300_27.jed](#)**.

JEDEC configuration files for 16, 18, 24, 27, and 32 bits data widths have been prepared in **[./lattice](#)**. If not running a 27 bit system, you have to adapt some **[./vhd/architecture_pkg.vhd](#)** constants according to the table "XP2-8E internal Memory Map" in the architecture file..

Running coretest.fs

First you have to make sure that the UART on your host matches the one specified in **[./gforth062.sh](#)**, which starts the gforth docker image. The command line in **[./software/umbilical.fs](#)** should match both your host's OS and umbilical UART. Please note that **[./gforth062.sh](#)** has been prepared for a Linux environment.

Open a terminal in the LFXP2_8_protoboard directory and execute **[./gforth062.sh](#)**. This will start gforth_0.6.2 with the focus in the software directory.

Enter `include load_core.fs<cr>`, which will load the cross-compiler and the code for the core test. When this has been successful, the last line displayed should read
3094 instructions compiled for microCore version 2300_27 ok

Enter `run<cr>`. If all goes well, HANDSHAKE will be displayed followed by the uCore> prompt on the next line.

Enter `coretest<cr>`. This will execute the core test. If all goes well, message: \$100 ok will be displayed. Any other number is an error code, which can be searched for in **[coretest.fs](#)**.