

Quick Start Guide

MSP430 Replicator



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ABSTRACT

This quick start guide explains how to set up the hardware and software of the MSP430 Replicator. After following the steps described in this document, you should be able to use the Replicator hardware as a stand-alone programmer for MSP430 devices (i.e. without using a host PC and IDE software). Detailed information and suggestions on how to develop your own production programmer can be found in the *MSP430 Programming Via the JTAG Interface User's Guide* ([SLAU320](#)) or directly derived from the Replicator source code.

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1 Hardware setup

 Before beginning to set up the Replicator for initial use, make sure that you have the following components available:

- a) REP430F board
- b) Power supply 9V DC
- c) Flash Emulation Tool (i.e. MSP-FET430UIF or MSP-FET)
- d) Target board (i.e. MSP430 target socket board)
- e) Code Composer Studio or IAR Embedded Workbench IDE installed on your host PC

In order to program other MSP430 devices with the Replicator, the host MCU on the REP430F target board itself has to be programmed first. Follow these steps to properly set up the Replicator hardware for programing the host firmware:

-  Power the REP430F board by connecting the 9V DC power supply to the black DC socket using a standard 2.1mm DC plug or to the blue DC connector using bare wires. The yellow LED labeled “+3V” should light up.
-  Connect the MSP430 Flash Emulation Tool (i.e. MSP-FET430UIF) to the host PC.
-  Connect the Flash Emulation Tool to the JTAG connector on the REP430F board, labeled “HOST” via the provided 14-wire JTAG cable.

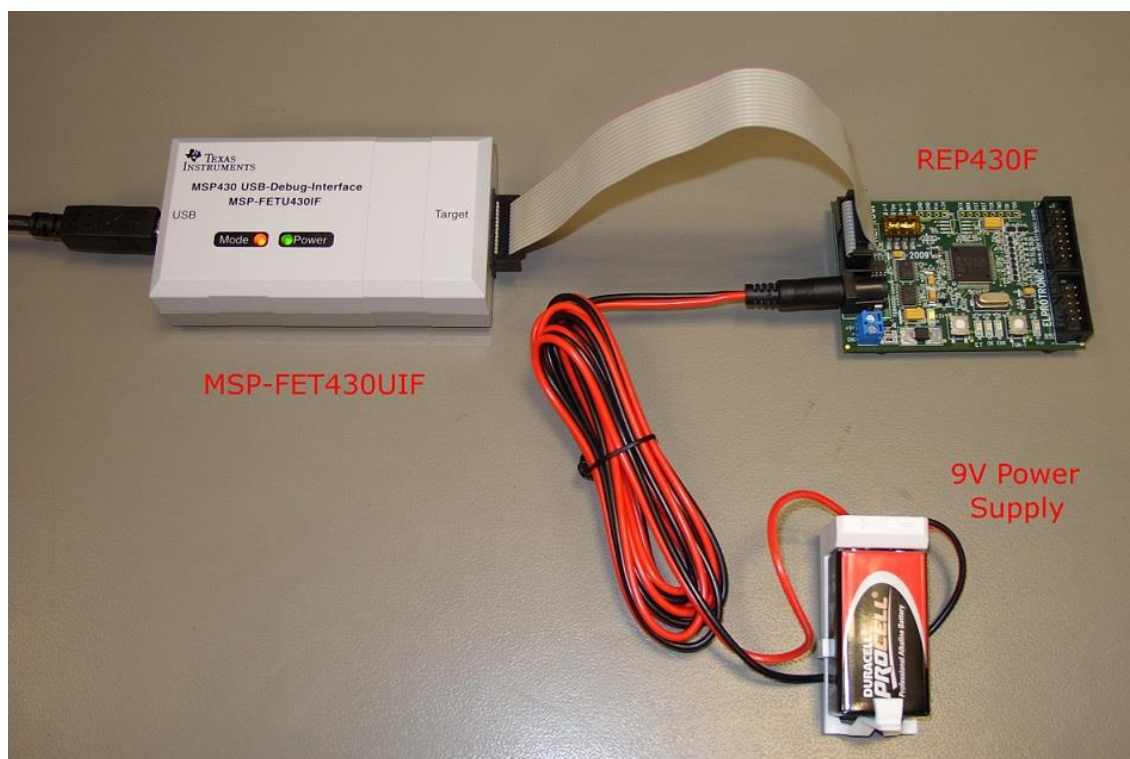


Figure 1 Hardware setup for the MSP430 Replicator

2 Project setup

The source code for the host controller firmware is included in the slau320.zip package. Project files are available for *Code Composer Studio (CCS)* and *IAR Embedded Workbench (EW430)*.

Using CCS, you can import the Replicator projects to your CCS workspace via **Project > Import Existing CCS/CCE Eclipse Project** from this directory:

<slau320>\CCS

The path of the Replicator workspaces for EW430 is:

<slau320>\IAR

NOTE: Both, the CCS and IAR projects use the same source code files. They are located in **<slau320>\Replicator430**, **<slau320>\Replicator430X**, **<slau320>\Replicator430Xv2** and **<slau320>\Replicator430FR** respectively.

Please note that the Replicator software consists of four different projects:

Replicator430 for programming devices with the MSP430 architecture such as

- Devices from the F1xx family (support for 4-wire JTAG)
- Older devices from the F2xx family (support for 4-wire JTAG and 2-wire Spy-Bi-Wire)
- Older devices from the F4xx family (support for 4-wire JTAG)

Replicator430X for programming devices with the MSP430X extended architecture such as

- Newer devices from the F2xx family (support for 4-wire JTAG)
- Newer devices from the F4xx family (support for 4-wire JTAG)

Replicator430Xv2 for programming devices with the MSP430Xv2 extended architecture such as


- Devices from the F5xx family (support for 4-wire JTAG and 2-wire Spy-Bi-Wire)
- Devices from the F6xx family (support for 4-wire JTAG and 2-wire Spy-Bi-Wire)
- FRAM devices (support for 4-wire JTAG and 2-wire Spy-Bi-Wire)

Replicator430FR for programming devices with FRAM memory

- Devices from the FR5xx family (support for 4-wire JTAG and 2-wire Spy-Bi-Wire)
- Devices from the FR6xx family (support for 4-wire JTAG and 2-wire Spy-Bi-Wire)



Choose the project that corresponds to the architecture of your target device. If you are not sure, which one to choose, refer to the section **JTAG Features Across Device Families** in the *MSP430 Programming Via the JTAG Interface User's Guide* ([SLAU320](#)).

 Once you have chosen the right Replicator project according to the architecture of your MSP430 target device, there are a few device specific changes in the source code which have to be configured before programming the host MSP on the Replicator board. To do this, open the configuration file in your IDE's project browser:

Config430.h / Config430X.h / Config430Xv2.h / Config430FR.h

This configuration file includes all high level functionality for user interaction, especially those options which need to be configured for an initial setup of the Replicator project. Figure 1 shows the “Quick Start Options” section in the configuration file.

```

/*****
/* QUICK START OPTIONS
*****/

//! Select the interface to be used to communicate with the device
//! Options: JTAG_IF | SPYBIWIRE_IF | SPYBIWIREJTAG_IF
//! Select ONLY ONE interface below, comment-out remaining options

//#define INTERFACE      JTAG_IF           //MCU has 4 wire JTAG ONLY
//#define INTERFACE      SPYBIWIRE_IF      //2 wire Spy-Bi-Wire
#define INTERFACE        SPYBIWIREJTAG_IF //4 wire JTAG in MCU with Spy-Bi-Wire

//! Set the target's Vcc level supplied by REP430F
//! data = 10*Vcc - range 2.1V to 3.6V or 0 (Vcc-OFF)
#define VCC_LEVEL        30

//! Set start address of the main memory
#define MAIN_START_ADDRESS 0xF000


//! Set length of main memory
//! Note that the memory length is counted in 16-bit WORDS!
#define MAIN_LENGTH 0x800

//! Set the start address of the device RAM
#define RAM_START_ADDRESS 0x1C00

*****/



```

Figure 2 Quick start options section in the Replicator configuration file

 Change, activate or deactivate these options according to your device's characteristics by simply commenting in/out the respective #defines or specifying different values. The options and their possible parameters along with an explanation are listed in Table 1.
If you are not sure which options apply for your device, refer to the device data sheet or look it up in the *MSP430 Programming Via the JTAG Interface User's Guide* ([SLAU320](#)).

Option	(Default) Value(s)	Explanation
INTERFACE	SPYBIWIREJTAG_IF	Choose this for 4-wire JTAG communication with a device that ALSO supports 2-wire Spy-Bi-Wire communication. (F2xx, F4xx with SBW, F5xx, F6xx, FRAM devices)
	JTAG_IF	Choose this, if your device supports 4-wire JTAG interface only. (F1xx, old F4xx)
	SPYBIWIRE_IF	Choose this for 2-wire Spy-Bi-Wire communication. (F2xx, F4xx with SBW, F5xx, F6xx, FRAM devices)
VCC_LEVEL	30 (default)	Specifies the voltage level for the target supplied by the Replicator board. Please note that the desired voltage value has to be multiplied by 10 (i.e. 3.0V = 30).
MAIN_START_ADDRESS (Replicator430Xv2 and Replicator430FR only)	0xF000	Specifies the start address of your device's main memory. (0xF000 is a value that is applicable for most MSP430 devices.)
MAIN_LENGTH (Replicator430Xv2 and Replicator430FR only)	0x800	Specifies the length of your device's main memory. Please note that this value is counted in 16-bit words instead of bytes. (0x800 is a value that is applicable for most MSP430 devices.)
RAM_START_ADDRESS (Replicator430Xv2 and Replicator430FR only)	0x1C00	Specifies the start address of your device's RAM. Certain MSP430 devices might have different RAM locations. Look up this value in the device data sheet.




Table 1 Quick start options

-  Now that your Replicator project is properly configured, the Replicator firmware can be programmed into the host controller on the REP430F board. To do so, simply open a debug session in your IDE.
-  After the IDE has finished loading the Replicator firmware, you can close the debug session and disconnect the Flash Emulation Tool from the REP430F board.

3 Start programming

The Replicator hardware now functions as a stand-alone programmer for MSP430 devices which match the selected parameters (i.e. JTAG/SBW interface, etc.). The default target code is a simple program which toggles Pin 1.0. For MSP430 target socket boards, this will cause LED1 to start blinking.

The binary code is initially programmed into the host controller's flash memory alongside the firmware. To load it into a target device, follow these steps:

-  Connect the target board to the JTAG connector on the REP430F board, labeled "TARGET", using a 14-wire JTAG cable.
-  If a certain interface can be selected on the target board (i.e. via a set of jumpers JTAG/SBW on MSP430 target socket boards), make sure it matches the interface specified in the Replicator configuration file.
-  Press the button labeled "S1" on the REP430F board to start the code download to the target device. Once it is finished, the green LED labeled "OK" will be switched on. If an LED is connected to P1.0 on the target board, it should start blinking.

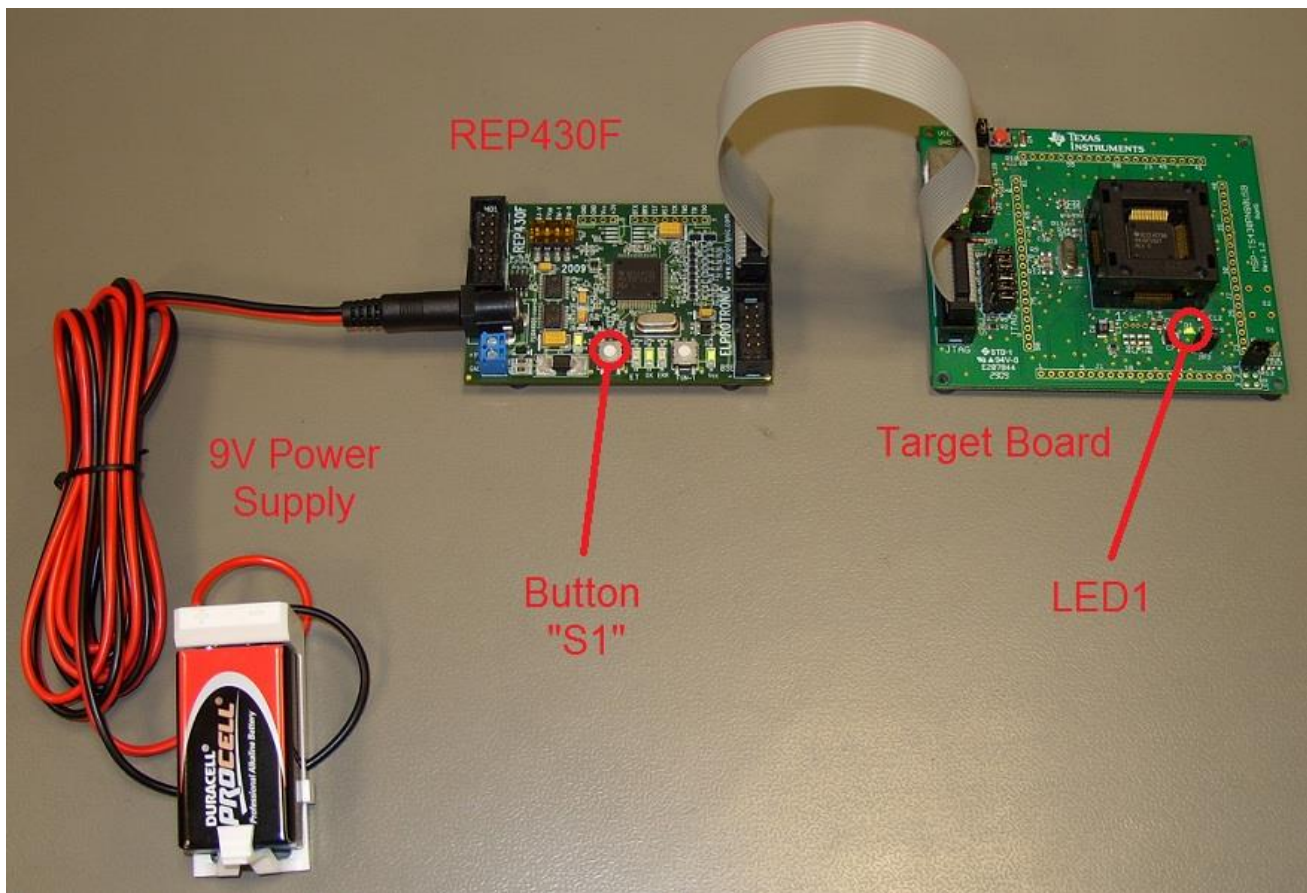



Figure 3 Using the REP430F as a stand-alone programmer

4 Include your own target code

In order to use the Replicator to program MSP430 devices with your own target code, follow these steps to convert your code into a format which is accepted by the Replicator source code.

-  Create a binary output file in **TI-txt** format for your project. In CCS, select the following option from the project settings:

Project properties > Build > Build Steps > Post-Build-Steps > Apply predefined step > “Create flash image: TI-txt”


Using EW430 you can generate a TI-txt output file by specifying this option:


Project options > Linker > Output > Format > Other > Output Format: “msp430-txt”

This will generate a “.d43” file which you will have to change to “.txt”.


-  Build your project and copy the generated binary files in TI-txt format in this directory:

<slau320>\Targetcode\SRecord

-  Download the open source conversion tool SRecord from <http://sourceforge.net/projects/srecord/files/> and place the included executables **srec_cat.exe** and **srec_info.exe** in **\Targetcode\SRecord** as well.

-  Run **srec.bat** from the command line and provide the file name (without the extension) as a parameter to start the conversion.

>> srec.bat my_file

-  SRecord now converts your TI-txt file to several other formats. Choose either the “.h”, “.asm” or the “.s43” file to include it in the Replicator project instead of the default blinking LED target code.

When repeating the steps described in section 3, the Replicator stand-alone programmer will now load your target code into the memory of MSP430 devices.