

AN00171: Interfacing FR CUBE with TI TMS570 Devices

FR CUBE is a Universal In-System Programmer, which uses the principles of In-Circuit Programming to program TI TMS570 family microcontrollers.

This Application Note assumes that you are familiar with both FR CUBE and the main features of the TMS570 family. Full documentation about these topics is available in the FR CUBE Series User's Manual and in device-specific datasheets.

1. Introduction

In-system programming of TMS570 microcontrollers is performed through JTAG protocol.

In order to use FR CUBE to perform in-system programming, you need to implement the appropriate in-circuit programming hardware interface on your application board.

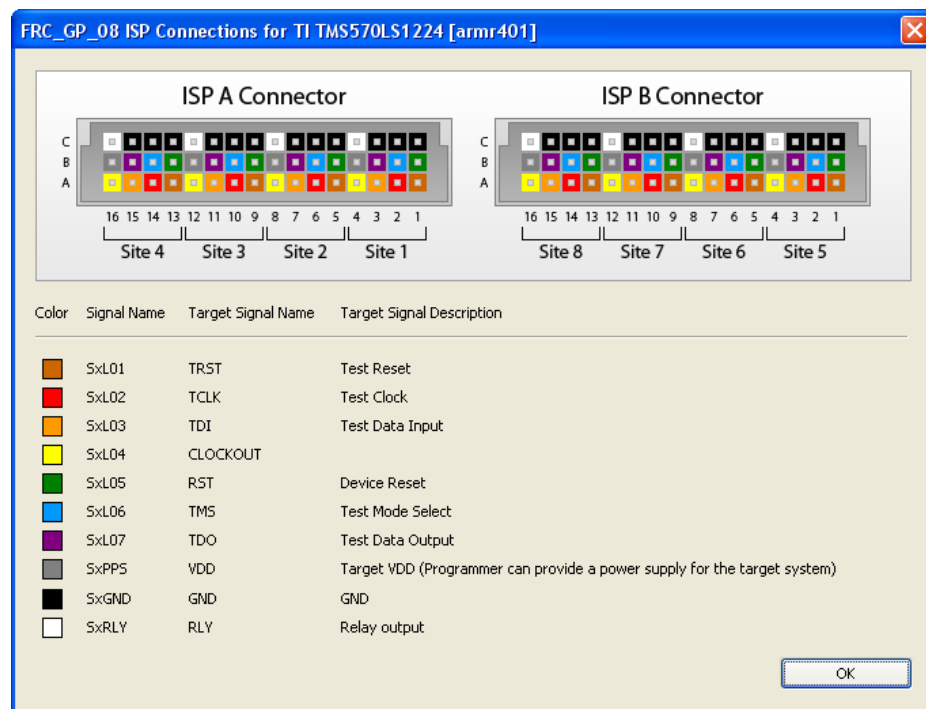
2. Hardware Configuration

The microcontroller lines needed to program a TMS570 device are the following:

- **TRST:** Test Reset.
- **TMS:** Test Mode Select

- **TCLK:** Test Clock.
- **TDO:** Test Data Output
- **TDI:** Test Data Input
- **RST:** Device Reset
- **GND:** Device power supply ground.

The lines mentioned above must be connected to the FR CUBE “ISP” connector according to the following diagram:



3. Specific Target ISP Configuration and Parameters

3.1 Target I/O

Device I/O voltage (mV)

Description:

This parameter defines the target device I/O lines voltage level. The voltage level of the target device can be different from the device main power voltage level.

Reset I/O drive mode

Description:

This parameter defines how the RESET line must be driven by the programmer during the programming operations.

3.2 Communication

Programming entry mode

Parameters:

reset – use the RESET line;

hotplug – not use and not drive the RESET line;

por – drive the pps and reset line to perform a power on reset;

Description:

This parameter defines the how the programmer uses the target device RESET line to enter in programming mode.

Communication frequency

Description:

This parameter defines the JTAG communication frequency (JTCLK).

3.3 Clock Settings

External oscillator frequency

Description:

This parameter defines the target device external oscillator clock frequency.

PLL mode

Parameters:

enable / disable;

Description:

This parameter enables or disables the internal PLL peripheral, which produces the maximum internal clock frequency, according to the external clock source.

3.4 Special Options

Programming mode

Parameters:

data_only – programs only the data buffer;

auto_ecc_generation – programs the data buffer and auto generates and programs the ECC;

Description:

This parameter enables or disables the auto-generation and programming of the ECC memory region.

4. Specific TPCMD Programming Commands

TI TMS570 specific target programming commands are the following:

- CHECK COMMUNICATION WITH DEVICE
- TEST COMMUNICATION WITH DEVICE
- UNPROTECT AND ERASE FLASH MEMORY
- ERASE FLASH MEMORY
- BLANK CHECK FLASH MEMORY
- PROGRAM FLASH MEMORY
- VERIFY FLASH MEMORY (READOUT METHOD)
- BLANK CHECK ECC MEMORY
- PROGRAM ECC MEMORY
- VERIFY ECC MEMORY (READOUT METHOD)

BLANKCHECK FLASH MEMORY

Description:

Blankchecks Flash and Data Flash memory regions.

ERASE FLASH MEMORY

Description:

Erases both Flash and Data Flash memory regions.

PROGRAM FLASH MEMORY

Description:

Programs the Flash and Data Flash memory regions.

VERIFY FLASH MEMORY (READOUT METHOD)

Description:

Verifies the Flash and Data Flash memory regions in “readout” mode.

BLANKCHECK ECC MEMORY

Description:

Blankchecks the ECC memory region.

PROGRAM ECC MEMORY

Description:

Programs the ECC memory region.

VERIFY ECC MEMORY (READOUT METHOD)

Description:

Verifies the ECC memory region in “readout” mode.

5. Project Example

```

////////////////////////////////////
// Loads target device driver
////////////////////////////////////
#load -l armr401.wnd -m TI -d TMS570LS1224
////////////////////////////////////
// Defines source & destination data
////////////////////////////////////
#data -o set -c in -t file -f \images\TMS570LS1224_image.wni
#data -o set -c out -t file -f \images\dump.bin
////////////////////////////////////
// Sets device-specific parameters
// These commands must NOT be modified by user
////////////////////////////////////
#dev -o begin
#dev -o set -p prjinf -v [h1020000]
#dev -o set -p devid -v [h3ba00477 h0 h169a862b hfffffff h6410041 hfffffff]
#dev -o set -p drvop -v [h100]
#dev -o set -p devpar -v [h7d0 he10 hce4 h186a0 hb71b00 hb71b00 h186a0]
#dev -o set -p mem0tch -v [h0 h8 h1 h0 hfffffff h1]
#dev -o set -p mem1tch -v [h0 h0 h0 h0 h0 h0]
#dev -o set -p mem2tch -v [h0 h8 h1 h0 hff h0]
#dev -o set -p mem0tgt -v [h2 h0 h1 h140000 h0 hf0200000 h1 h10000 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0]
#dev -o set -p mem1tgt -v [h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0]
#dev -o set -p mem2tgt -v [h2 hf0100000 h1 h2000 h0 hf0400000 h1 h28000 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0]
#dev -o set -p mem4tgt -v [h1 h8000000 h1 h30000 h0]
#dev -o set -p mem0log -v [h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0 h0]
#dev -o set -p pkca -v [h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00 h00]
#dev -o set -p pkc1 -v [h74 h6d h73 h35 h37 h30 h30 h32 h00]
#dev -o end
////////////////////////////////////
// Sets target-specific parameters
// These commands CAN be modified by user
////////////////////////////////////
#conf -o begin
// Target I/O settings
// Target I/O
// Set Device I/O voltage (mV)
#conf -o set -p vddio -v 3300
// Set Reset up time (us)
#conf -o set -p rstup time -v 100
// Set Reset down time (us)
#conf -o set -p rstdw time -v 100
// Set Reset I/O drive mode
#conf -o set -p rstio drive -v opendrain
// Set Clock I/O drive mode
#conf -o set -p clkio drive -v tristate
// Set Clock I/O frequency (Hz)
#conf -o set -p clkio freq -v 16000000
// Target Power Supply settings
// Target Power Supply
// Set Target power supply voltage (mV)
#conf -o set -p pps voltage -v 3300
// Set Power up time (ms)
#conf -o set -p pps uptime -v 100
// Set Power down time (ms)
#conf -o set -p pps dwtime -v 100
// Communication settings
// Communication
// Set Communication protocol
#conf -o set -p protocol -v JTAG
// Set Programming entry mode
#conf -o set -p entry mode -v reset
// Set Communication frequency (Hz)
#conf -o set -p bitrate -v 12000000
// Clock Settings settings
// Target Clock Settings
// Set External oscillator frequency (Hz)
#conf -o set -p ext osc -v 16000000
// Set PLL mode
#conf -o set -p pll mode -v enable
// Set PLL parameters
#conf -o set -p pll pars -v [48000000 h21075F00 h3FC0723D]
// Set System clock frequency (Hz)
#conf -o set -p sysclk -v 48000000
// Special Options settings
// Special Options

```

```
// Set Programming mode
#conf -o set -p prg_mode -v data_only
#conf -o end
// Drives relays outputs to CLOSE state
#relay -o close
////////////////////////////////////
// Programming steps
////////////////////////////////////
#prog -o begin
// Unprotect and Erase flash memory
#prog -o cmd -c erase -m all
// Erases FLASH memory
#prog -o cmd -c erase -m flash -t h0000 -l h140000
#prog -o cmd -c erase -m flash -t hf0200000 -l h10000
// Blank Check FLASH memory
#prog -o cmd -c blankcheck -m flash -t h0000 -l h140000
#prog -o cmd -c blankcheck -m flash -t hf0200000 -l h10000
// Programs FLASH memory
#prog -o cmd -c program -m flash -s h0000 -t h0000 -l h140000
#prog -o cmd -c program -m flash -s hf0200000 -t hf0200000 -l h10000
// Verifies FLASH memory read out method)
#prog -o cmd -c verify -v read -m flash -s h0000 -t h0000 -l h140000
#prog -o cmd -c verify -v read -m flash -s hf0200000 -t hf0200000 -l h10000
// Blank Check ECC memory
#prog -o cmd -c blankcheck -m ecc -t hf0100000 -l h2000
#prog -o cmd -c blankcheck -m ecc -t hf0400000 -l h28000
// Programs ECC memory
#prog -o cmd -c program -m ecc -s hf0100000 -t hf0100000 -l h2000
#prog -o cmd -c program -m ecc -s hf0400000 -t hf0400000 -l h28000
// Verifies ECC memory read out method)
#prog -o cmd -c verify -v read -m ecc -s hf0100000 -t hf0100000 -l h2000
#prog -o cmd -c verify -v read -m ecc -s hf0400000 -t hf0400000 -l h28000
// Target disconnection
@if site in ok
// These commands will be executed for sites in OK
#site -o set -s ok
// Sets ISP lines in tristate
#prog -o cmd -c disconnect
@endif
@if site in error
// These commands will be executed for sites in ERR
#site -o set -s err
// Sets ISP lines in tristate
#prog -o cmd -c disconnect
@endif
#prog -o end
// Drives relays outputs to OPEN state
#relay -o open
////////////////////////////////////
!/ Reserved for Project Creation Wizard
////////////////////////////////////
!/ -W PROGCMD -P PPS ON -V 0
!/ -W PROGCMD -P CONNECT -V 0
!/ -W PROGCMD -P CONNECT TEST -V 0
!/ -W PROGCMD -P ERASE ALL -V 1
!/ -W PROGCMD -P ERASE FLASH -V 1
!/ -W PROGCMD -P BLANKCHECK_FLASH -V 1
!/ -W PROGCMD -P PROGRAM_FLASH -V 1
!/ -W PROGCMD -P VERIFY_FLASH_READ -V 1
!/ -W PROGCMD -P READ_FLASH -V 0
!/ -W PROGCMD -P BLANKCHECK_ECC -V 1
!/ -W PROGCMD -P PROGRAM_ECC -V 1
!/ -W PROGCMD -P VERIFY_ECC_READ -V 1
!/ -W PROGCMD -P READ_ECC -V 0
!/ -W PROGCMD -P RUN -V 0
!/ -W CHK: 438238
```


6. Programming Times

The following table shows programming times for selected TI TMS570 family devices.

Device	Mem. Size	Conditions	Operations	Time
TMS570LS1224	1.25MB OF FLASH MEMORY + 64KB OF DATA FLASH	JTAG, VDD = 3V3, JTCK = 12MHZ	UNPROTECT AND ERASE FLASH MEMORY, ERASE FLASH MEMORY, BLANK CHECK FLASH MEMORY, VERIFY FLASH MEMORY (READOUT METHOD), BLANK CHECK ECC MEMORY, PROGRAM ECC MEMORY, VERIFY ECC MEMORY (READOUT METHOD).	10,922 s

Programming times depend on Programming Algorithm version, target board connections, communication mode, target microcontroller mask, and other conditions. Programming times for your actual system may therefore be different than the ones listed here. SysteIn Italia reserves the right to modify Programming Algorithms at any time.

7. References

FR CUBE User's Manual

Microcontroller-specific datasheets