

AN00157: Interfacing FlashRunner with TI UCD30XX Devices

FlashRunner is a Universal In-System Programmer, which uses the principles of In-Circuit Programming to program TI UCD30XX family microcontrollers.

This Application Note assumes that you are familiar with both FlashRunner and the main features of the UCD30XX family. Full documentation about these topics is available in the FlashRunner user's manual and in device-specific datasheets.

1. Introduction

In-system programming of UCD30XX microcontrollers is performed through PMBUS open protocol.

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

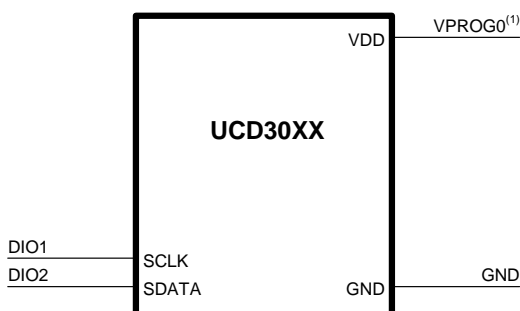
2. Hardware Configuration

The microcontroller lines needed to program an UCD30XX device are the following:

- **SCLK:** PMBUS clock frequency.

- **SDATA:** PMBUS data line
- **VDD:** Device power supply voltage.
- **GND:** Device power supply ground.

The lines mentioned above must be connected to the FlashRunner's "ISP" connector according to the following diagram:



⁽¹⁾ Connect this line if you want FlashRunner to automatically power the target device

3. Specific TCSETPAR Programming Commands

Overview

TCSETPAR commands set device-specific and programming algorithm-specific parameters. These commands must be sent after the **TCSETDEV** command and before a **TPSTART** / **TPEND** command block.

All of the following parameters must be correctly specified through the relative **TCSETPAR** commands (although the order with which these parameters are set is not important):

- Communication frequency;

TCSETPAR SCLK

Command syntax:

TCSETPAR SCLK <frequency Hz>

Parameters:

frequency Hz: communication frequency, expressed in Hertz.

Description:

This command is used to set up the communication frequency between FlashRunner and target microcontroller. Must be less than 400 KHz.

4. Specific TPCMD Programming Commands

Overview

TPCMD commands perform a programming operation (i.e. mass erase, program, verify, etc.) These commands must be sent within a **TPSTART** / **TPEND** command block.

TI UCD30XX specific target programming commands are the following:

- **TPCMD BLANKCHECK;**
- **TPCMD MASSERASE;**
- **TPCMD ERASE**
- **TPCMD PROGRAM;**
- **TPCMD VERIFY;**
- **TPCMD READ;**
- **TPCMD RUN.**
- **TPCMD ROMBACK**

TPCMD BLANKCHECK

Command syntax:

```
TPCMD BLANKCHECK F|E <tgt start addr> <len>
```

Command parameters and options:

- F|E:** Specifies Program flash (**F**) or Code flash (**E**) memory.
- tgt start address:** Device memory location from where the blankcheck operation will start.

len: Number of locations to be blankchecked.

Description:

Blankchecks Program flash or Code flash memory. Blankchecks **len** locations starting from the address specified by **tgt start address**.

TPCMD MASSERASE

Command syntax:

TPCMD MASSERASE C|F|E

Command options:

C|F|E: Specifies Chip (C), Program flash (F) or Code flash (E)

Description:

'C' parameter erase Program flash (F) and Code flash (E). 'F' erases Program flash, 'E' erases Code flash.

TPCMD ERASE

Command syntax:

TPCMD ERASE F|E <tgt start addr> <len>

Command options:

F|E: Specifies Program flash (F) or Code flash (E)

tgt start addr: Device memory location from where the erase operation will start.

len: Number of locations to be erased.

Description:

'F' parameter erases Program flash, 'E' parameter erases Code flash. Please note that number of erased locations will be approximated to the last flash block indicated by **tgt start addr + len** formula.

TPCMD PROGRAM

Command syntax:

```
TPCMD PROGRAM F|E <src offset> <tgt start addr> <len>
```

Command parameters and options:

F|E: Specifies Program flash (F) memory or Code flash (E).

src offset: Offset from the beginning of the source memory.

tgt start addr: Device memory location from where the program operation will start.

len: Number of locations to be programmed.

Description:

Programs **len** locations of Program flash memory or Code flash memory starting from the **tgt start addr** address. Last 4 locations are dedicated to firmware checksum, if checksum is not correct, device will remain in ROM mode. If the checksum is correct but firmware doesn't run, device will be lost after resetting the device.

TPCMD VERIFY

Command syntax:

```
TPCMD VERIFY F|E R|S <src offset> <tgt start addr> <len>
```

Command parameters and options:

F|E: Specifies Program flash (F) or Code flash (E) memory.

R|S Specifies Readout (R) or CheckSum (S).

src offset: Offset from the beginning of the source memory.

tgt start addr: Device memory location from where the verify operation will start.

len: Number of locations to be verified

Description:

Verifies **len** locations of Program flash or Code flash memory starting from the **tgt start addr** address.

TPCMD READ

Command syntax:

```
TPCMD READ F|E <tgt start addr> <len>
```

Command parameters and options:

F|E: Specifies Program flash (F) memory or Code flash (E).

tgt start addr: Device memory location from where the read operation will start.

len: Number of locations to be read.

Description:

Reads len locations of Program flash or Code flash memory starting from the **tgt start addr** address.

TPCMD RUN

Command syntax:

```
TPCMD RUN
```

Command parameters:

None.

Description:

Runs the target application. This command starts the programmed firmware only if executed in the same session as PROGRAM command. It doesn't check if checksum locations are correct.

TPCMD ROMBACK

Command syntax:

```
TPCMD ROMBACK <command> <delay> <device_id> <pw_length> <pw>
```

command Command to return in ROM mode

delay Delay [msec] before a new boot ROM command.

device_ID UCD3XXX ID code

pw_length If pw_length IS '0' no password will be sent

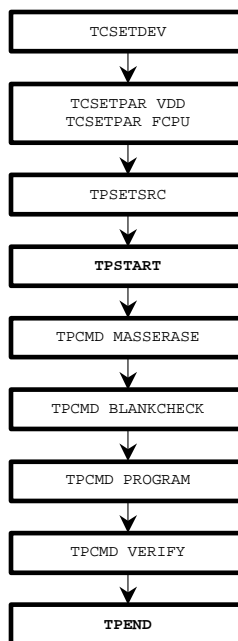
pw User defined password, **pw_length** byte will be transmitted

Command parameters:

This command is used to go back to ROM mode when a customer firmware is running on the device. Please note that **command**, **device_ID** code as well as **pw** are user definable. Moreover **pw** is optional and if not present, could be ignored putting '0' value to **pw_length**.

5. Typical Programming Flow

The following flow chart illustrates typical steps to help you write your own script file.



6. Script Example

The example below shows a typical programming flow for a TI UCD30XX device.

```
;
; FLASHRUNNER SCRIPT EXAMPLE FOR TI UCD3020
;
; Use this example as a starting point for your specific programming needs
;
;
; -----
; HARDWARE CONNECTIONS
; -----
; DIO1 (SCLK)
; DIO2 (SDATA)
;

; Turns off logging
#LOG_OFF
; Halt on errors
#HALT ON FAIL

; Sets device
TCSETDEV TI UCD3020 TI D

; -----
; ATTENTION: for more information on the available commands and parameter tuning
; please visit our website: http://www.smh-tech.com, click on 'Support & download' menu, Download Area section and
; 'Application Note' subsection and download the document related to the specific programming algorithm
; -----

;-----
; SETTINGS
;-----
; Target voltage, mV (change as needed)
TCSETPAR VDD 3300

; VDD Rise-Time, ms (change as needed)
TCSETPAR PWUP 1

; VDD Fall-Time, ms (change as needed)
TCSETPAR PWDOWN 1
```



```

; I2C clock frequency, Hz (change as needed)
; For this device the maximum clock frequency is 400000 Hz
TCSETPAR SCLK 400000

; Image file to be programmed (must be placed in the \BINARIES directory)
TPSETSRC FILE FLASH.FRB

;-----
; START PROGRAMMING SESSION
;-----
TPSTART

; This instruction is needed only for re-programming of device (Firmware UPDATE)
; This instruction permits to restore ROM mode from Flash mode (change command, delay, Device ID as needed, password
length, password as needed)
; If you don't have a password put '0' in password length field, otherwise indicate password length (max 4 bytes) and
then put it on password field (refer TI Application Note for related firmware requirements)
; TPCMD ROMBACK $D9 100 UCD3000ISO1|1.0.2|090707 0
; TPCMD ROMBACK $26 100 UCD3000ISO1|1.0.2|090707 4 $34129078

; Mass erases complete Flash Memory, Program memory, Data memory (C/F/E)
TPCMD MASSERASE C

; Erase Program/Data page (F/E) (change address and lenght as needed)
;TPCMD ERASE F $10000 $8000

; Blank checks Program/Data (F/E) memory (change address and lenght as needed)
; TPCMD BLANKCHECK F $10000 $8000

; Programs Program (F/E) memory (change addresses and lenght as needed)
TPCMD PROGRAM F $10000 $10000 $8000
TPCMD PROGRAM E $18800 $18800 $800

; Verifies Program (F/E) memory (change source, target address and length as needed)
; If you want you can choose between two type of verification:
; 1) CheckSum method (S) (Recommended)
; 2) Read-Out method (R)
TPCMD VERIFY F S $10000 $10000 $8000
TPCMD VERIFY E S $18800 $18800 $800

; Run program.
; Works only if issued in the same session as PROGRAM command.
; TPCMD RUN

; Ends programming block

```

TPEND

The FlashRunner's system software setup will install script examples specific for each device of the UCD30XX family on your PC.

7. Programming Times

The following table shows programming times for selected TI UCD30XX family devices.

Device	Mem. Size	Conditions	Operations	Time
UCD3020	32 Kb Program Flash	SCLK=400 KHz	Masserase chip + Blanckcheck + Program + Verify ReadOut	7,81 s
UCD3020	32 Kb Program Flash	SCLK=400 KHz	Masserase chip + Blanckcheck + Program + Verify CheckSum	5,34 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. SMH Technologies reserves the right to modify Programming Algorithms at any time.

8. References

FlashRunner user's manual
Microcontroller-specific datasheets