02 September 2024 SMH Technologies (Ivan Liberotti)

Interfacing FlashRunner with Aurix TriCore MCUs



Introduction	3
TC2xx UCB sectors	3
UCB0 = UCB_PFlash <i>[0xAF100000 – 0xAF1003FF]</i>	4
UCB1 = UCB_DFlash [0xAF100400 – 0xAF1007FF]	5
UCB2 = UCB_HSMCOTP [0xAF100800 – 0xAF100BFF]	6
UCB3 = UCB_OTP [0xAF100C00 – 0xAF100FFF]	7
UCB5 = UCB_DBG [0xAF101400 – 0xAF1017FF]	8
UCB6 = UCB_HSM [0xAF101800 – 0xAF101BFF]	9
TC3xx UCB sectors	10
TC3xx/TC2xx UCB Correspondances	11
TC2xx/TC3xx UCB sectors unlocking related commands	12
TPCMD DISABLE_PROTECTION F	12
TPCMD DISABLE_PROTECTION D	13
TPCMD CONNECT with a Debug Locked device	14
TPCMD DISABLE_PROTECTION U (only on TC3xx)	15
TPCMD DISABLE_UCB_OTHER U (only on TC3xx)	16
Most common bricks	17
FlashBunner 2 O Connect Flow	18

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DC11500

FlashRunner 2.0 Connect User Cases	19
Driver Commands	24
#TPCMD READ_PART_NUMBER	
#TPCMD CONNECT	
#TPCMD MASSERASE F D	
#TPCMD SECTOR_ERASE F D <start address=""> <size></size></start>	
#TPCMD BLANKCHECK F D or #TPCMD BLANKCHECK F D <start address=""> <size></size></start>	
#TPCMD PROGRAM F D U or #TPCMD PROGRAM F <start address=""> <size></size></start>	
#TPCMD VERIFY F D U R S or #TPCMD VERIFY F R S <start address=""> <size></size></start>	
#TPCMD VERIFY_MARGIN F D:	
#TPCMD READ_REGISTER < register address >	25
#TPCMD RUN <time></time>	
#TPCMD READ F D U <start address=""> <size></size></start>	25
#TPCMD DUMP F D U <start address=""> <size></size></start>	
#TPCMD READ_CRC32 <start address=""> <size></size></start>	
#TPCMD RESTORE_UCB_TC3xx	
#TPCMD RESTORE_UCB_TC2xx	25
#TPCMD DISABLE_PROTECTION F D	25
#TPCMD DISABLE_PROTECTION U 0 1 2 3	
#TPCMD UNLOCK	
#TPCMD DISABLE_UCB_OTHER U E S	
#TPCMD VERIFY_PAGE_ERASED <start address=""> <size></size></start>	
Driver Parameters	
#TCSETPAR JTAG_PINOUT YES/NO	
#TCSETPAR PRINT_ON_TERMINAL YES/NO	
#TCSETPAR WD_DUTYCYCLE	
#TCSETPAR WD_FREQUENCY	
Conclusions	27

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Introduction

TC2xx/TC3xx devices are very complex and delicate architectures and they have a lot of protection customizations, mostly located in the **User Configuration Block (UCB)**. The aim of this application note is to explain in detail the **UCB** memory area and the related protections, how they affect the programming/reprogramming and how to handle them through **FlashRunner 2.0**; furthermore, a general overview of the most common mistakes made by using **FlashRunner 2.0** on these architectures will be given.

TC2xx UCB sectors

To begin with, every UCB sector is controlled by the *Confirmation Code (CC)* and its copy which are programmed in the middle of every of them and should always contain the same value.

These bytes are used to set the state of the UCB sectors:

- 1) Factory bytes state = $0x43211234 \rightarrow Unlocked State$ (Default)
- 2) 0x57B5327F → Locked state

It is possible to distinguish the UCB sectors with a field dedicated to a password from the ones that do not have any password field; the former are:

- 1) UCB0 = UCB_PFlash
- 2) UCB1 = UCB_DFlash
- 3) UCB5 = UCB_DBG

The latter are:

- 1) UCB2 = UCB_HSMCOTP
- 2) UCB3 = UCB_OTP
- 3) UCB6 = UCB_HSM

Every sector left in Unlocked State can be programmed/reprogrammed/restored by FlashRunner 2.0.

If a sector that belongs to the first category has been brought to *Locked state,* it could be reprogrammed/restored by *FlashRunner 2.0* by providing the password programmed in the password field (the commands will be analyzed later in detail).

If a sector that belongs to the second category has been brought to *Locked state,* there is no possibility to reprogram/restore it.

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Offset(h)	00	01	02	03	04	05	06	07	80	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1 A	1B	1C	1D	1E	15
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
0800000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000000A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000000C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000000E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000140	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000160	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000180	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001 A 0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000200	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000220	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000240	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000260	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000280	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000300	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000320	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000340	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000360	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000380	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000003A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000003C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000003E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
										_																						

UCB0 = UCB_PFlash [0xAF100000 - 0xAF1003FF]

Figure 1: UCB_PFlash factory values

This sector is dedicated to set *Write Protection (WP), One Time Programmable Protection (OTPP)* and Write Once Protection (WOP) on defined PFLASH sectors. It is also possible to set *Read* Protection and Global Write Protection on PFLASH.

This sector can always be reprogrammed/restored, independently from its *CC state*.

The only thing to keep in mind is that if it is in *Locked state,* the way to reprogram/restore it is to provide the correct password to unlock it before executing the related command *"TPCMD DISABLE_PROTECTION F"*

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Offset(h)	00	01	02	03	04	05	06	07	80	09	0 A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1 A	1B	1C	1D	1E	1F
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
08000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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000000C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000100	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000160	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000220	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000240	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000260	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000280	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002 A 0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000300	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000320	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000340	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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UCB1 = UCB_DFlash [0xAF100400 - 0xAF1007FF]

Figure 2: UCB_DFlash factory values

This sector is dedicated to set *WP* on the whole *DFLASH* memory. It is also possible to set *Global Protection* on *DFLASH*.

This sector can always be reprogrammed/restored, independently from its *CC state*.

The only thing to keep in mind is that if it is in *Locked state,* the way to reprogram/restore it is to provide the correct password to unlock it before executing the related command *"TPCMD DISABLE_PROTECTION D"*

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0002 0		<u> </u>	101		0.	• 1	070		10.						00	011	1															
Offset(h)	00	01	02	03	04	05	06	07	80	09	0 A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1A	1в	1C	1D	1E	1E
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00.	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000180	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000200	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000220	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000240	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000260	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000280	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000320	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000340	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000360	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000380	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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UCB2 = UCB HSMCOTP [0xAF100800 - 0xAF100BFF]

Figure 3: UCB_HSMCOTP factory values

This sector contains multiple *CC* entries and every of them should be treated as a different and independent block, even if they are contained in the same sector.

This sector is dedicated to enable the *Hardware Security Module (HSM)* boot, to set the *HSM_exclusive attribute* to particular **PFLASH** sectors and the *OTPP* to the same sectors.

Once a *CC* entry has been brought to *Locked state,* the content can no longer be modified since this sector belongs to the second category.

HQ and Registered Office Via Giovanni Agnelli 1 33083 Villotta di Chions (PN) Italy Società Unipersonale Capitale sociale €102.040 P.I. 01697470936 C.F. 01697470936 REA PN-97255 D-U-N-S[®] 51-724-9350 T + 39 0434 421 111 F + 39 0434 639 021 UNIVERSAL PRODUCTION IN-SYSTEM PROGRAMMING

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Offset(h)	00	01	02	03	04	05	06	07	80	09	0 A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1 A	1B	1C	1D	1E	1F
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
08000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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000000C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000000E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
00000100	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000140	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000160	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
00000180	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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000001C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
00000200	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000220	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000240	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000260	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
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000002C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
00000300	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000320	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000360	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
00000380	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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000003E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00

Figure 4: UCB OTP factory values

This sector contains multiple *CC* entries and every of them should be treated as a different and independent block, even if they are contained in the same sector.

This sector is dedicated to set OTPP and WOP on defined PFLASH sectors.

UCB3 = UCB_OTP [0xAF100C00 - 0xAF100FFF]

Once a *CC* entry has been brought to *Locked state,* the content can no longer be modified since this sector belongs to the second category.

HQ and Registered Office Via Giovanni Agnelli 1 33083 Villotta di Chions (PN) Italy Società Unipersonale Capitale sociale €102.040 P.I. 01697470936 C.F. 01697470936 REA PN-97255 **D-U-N-S**[®] 51-724-9350 **T** + 39 0434 421 111 **F** + 39 0434 639 021 UNIVERSAL PRODUCTION IN-SYSTEM PROGRAMMING

→ smh-tech.com Page 7 of 27 info@smh-tech.com

Offset(h)	00	01	02	03	04	05	06	07	80	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1 A	1B	1C	1D	1E	1F
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
08000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000180	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001 A 0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000220	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000240	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000260	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000280	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002 A 0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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00000320	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000340	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000360	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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Figure 5: UCB_DBG factory values

This sector is dedicated to lock the Debug Port.

UCB5 = UCB_DBG [0xAF101400 - 0xAF1017FF]

This sector can always be reprogrammed/restored, independently from its CC state.

The only thing to keep in mind is that if it is in *Locked state,* the way to reprogram/restore it is to provide the correct password to unlock it before executing the command *"TPCMD CONNECT".*

When this protection is set, there is no possibility to connect to the target without providing the right password stored into this sector.

HQ and Registered Office Via Giovanni Agnelli 1 33083 Villotta di Chions (PN) Italy Società Unipersonale Capitale sociale €102.040 P.I. 01697470936 C.F. 01697470936 REA PN-97255 **D-U-N-S**[®] 51-724-9350 **T** + 39 0434 421 111 **F** + 39 0434 639 021 UNIVERSAL PRODUCTION IN-SYSTEM PROGRAMMING

→ smh-tech.com Page 8 of 27 info@smh-tech.com

Offset(h)	00	01	02	03	04	05	06	07	80	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1 A	1B	1C	1D	1E	1F
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	34	12	21	43	00	00	00	00
08000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
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000002C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000002E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000300	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000320	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000340	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000360	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000380	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000003 A 0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000003C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000003E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Figure 6: UCB_HSM factory values

This sector is dedicated to configure the HSM.

UCB6 = UCB_HSM [0xAF101800 - 0xAF101BFF]

Once the *CC* has been brought to *Locked state,* the content can no longer be modified since this sector belongs to the second category.

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→ smh-tech.com Page 9 of 27 info@smh-tech.com

TC3xx UCB sectors

To begin with, every UCB sector is controlled by the *CC*: differently from what happens on their predecessors, *TC3xx* devices have entire copy sectors: there is an original sector and a copy sector for each of them. It does not happen anymore that copy data are stored in the same sector. The idea is the same anyway, they should contain the same values.

CC bytes are used to set the state of the UCB sectors:

- 1) Factory bytes state = 0x43211234 → Unlocked State (Default)
- 2) $0x57B5327F \rightarrow$ Locked state

It is possible to distinguish the UCB sectors with a field dedicated to a password from the ones that do not have any password field; the former are:

- 1) UCB_BMHD0_ORIG andUCB_BMHD0_COPY ([0xAF400000-0xAF4001FF], [0xAF401000-0xAF4011FF])
- 2) UCB_BMHD1_ORIG and UCB_BMHD1_COPY ([0xAF400200-0xAF4003FF], [0xAF401200-0xAF4013FF])
- 3) UCB_BMHD2_ORIG and UCB_BMHD2_COPY ([0xAF400400-0xAF4005FF], [0xAF401400-0xAF4015FF])
- 4) UCB BMHD3 ORIG and UCB BMHD3 COPY ([0xAF400600-0xAF4007FF], [0xAF401600-0xAF4017FF])
- 5) UCB_PFLASH_ORIG and UCB_PFLASH_COPY ([0xAF402000-0xAF4021FF], [0xAF403000-0xAF4031FF])
- 6) UCB DFLASH ORIG and UCB DFLASH COPY ([0xAF402200-0xAF4023FF], [0xAF403200-0xAF4033FF])
- 7) UCB DBG ORIG and UCB DBG COPY ([0xAF402400-0xAF4025FF], [0xAF403400-0xAF4035FF])
- 8) UCB_ECPRIO_ORIG and UCB_ECPRIO_COPY ([0xAF402C00-0xAF402DFF], [0xAF403C00-0xAF403DFF])
- 9) UCB_SWAP_ORIG and UCB_SWAP_COPY ([0xAF402E00-0xAF402FFF], [0xAF403E00-0xAF403FFF])

The latter are:

- 1) UCB_HSM_ORIG and UCB_HSM_COPY ([0xAF402600-0xAF4027FF], [0xAF403600-0xAF4037FF])
- UCB_HSMCOTPx_ORIG and UCB_HSMCOTPx_COPY ([0xAF402800-0xAF402BFF], [0xAF402800-0xAF402BFF])
- 3) UCB_OTPx_ORIG and UCB_OTPx_COPY ([0xAF404000-0xAF404FFF], [0xAF405000-0xAF405FFF])

Every sector left in Unlocked State can be programmed/reprogrammed/restored by FlashRunner 2.0.

If a sector that belongs to the first category has been brought to *Locked state,* it could be reprogrammed/restored by *FlashRunner 2.0* by providing the password programmed in the password field (the commands will be analyzed later in detail).

If a sector that belongs to the second category has been brought to *Locked state,* there is no possibility to reprogram/restore it.

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All the programmable TC3xx UCB sectors have the same default content.

Offset(h)	00	01	02	03	04	05	06	07	80	09	0 A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17	18	19	1 A	1B	1C	1D	1E	1F
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0800000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000000A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000000	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000000E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000100	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000140	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000160	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00000180	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
000001E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	34	12	21	43	00	00	00	00	00	00	00	00	00	00	00	00

Figure 7: TC3xx programmable UCB sectors default values

TC3xx/TC2xx UCB Correspondances

 $UCB_PFLASH_ORIG \rightarrow UCB_PFlash$ $UCB_DFLASH_ORIG \rightarrow UCB_DFlash$ $UCB_DBG_ORIG \rightarrow UCB_DBG$ $UCB_HSM_ORIG \rightarrow UCB_HSM$ $UCB_HSMCOTPx_ORIG \rightarrow UCB_HSMCOTP$ $UCB_OTPx_ORIG \rightarrow UCB_OTP$

Everything said before for the **TC2xx UCB** sectors written above applies to the related **TC3xx UCB** sectors.

For sectors like UCB_BMHDx_ORIG, UCB_ECPRIO_ORIG and UCB_SWAP_ORIG it is important to remember that to reprogram/restore them, the right password needs to be provided before executing related unlocking command: TPCMD DISABLE_PROTECTION U 0/1/2/3 (for the different UCB_BMHDx_ORIG sectors), TPCMD DISABLE_UCB_OTHER U E/S (for the different UCB_ECPRIO_ORIG and UCB_SWAP_ORIG sectors).

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TC2xx/TC3xx UCB sectors unlocking related commands

These set of commands will help the user handling the protections enabled during a programming session.

TPCMD DISABLE_PROTECTION F

When the UCB_PFLash (UCB_PFLASH_ORIG) has some protection set, FlashRunner 2.0 is able to recognize them during the CONNECT command:

-		
	08 2#TPSTART	
	08 2 >	
	08 2#TPCMD CONNECT	
	08 2 Protocol clock = 25.00 MHz	
	08 1 Good samples: 5 [Range 0 ~ 0 and 2 ~ 5]	
	08 2 Found write protection in one or more sectors of PFLASH BANK 0 🧲	_
	08 2 Debug port and OCDS are not locked	•
	08 1 Time for Connect: 109 ms	
	08/2/>	

Under this condition, it is not possible to touch those protected *PFLASH* sectors. Launching a *MASSERASE F* command would invade those protected areas:



The given suggestion is to use the **DISABLE_PROTECTION F** (remember to provide the right password):

08 2#TPSTART
08 2 >
08 2 #TPCMD CONNECT
08 2 Protocol clock = 25.00 MHz
08 1 Good samples: 5 [Range 0 ~ 0 and 2 ~ 5]
08 2 Found write protection in one or more sectors of PFLASH BANK 0
08 2 Debug port and OCDS are not locked
08 1 Time for Connect: 109 ms
08 2 >
082#TPCMD DISABLE_PROTECTION F
08 1 Time for disable protection: 1 ms
08 2 >
08 2#TPCMD MASSERASE F
08 1 Time for Masserase F: 1728 ms
08 2 >

In this way, it is possible to update the **PFLASH** content even if those protections are set. Without the command **DISABLE_PROTECTION F**, it is possible to update only the not protected area.

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TPCMD DISABLE_PROTECTION D

When the UCB_DFLash (UCB_DFLASH_ORIG) has some protection set, FlashRunner 2.0 is able to recognize them during the CONNECT command:

08 2#TPSTART
08 2 >
08 2#TPCMD CONNECT
08 2 Protocol clock = 25.00 MHz
08 1 Good samples: 5 [Range 0 ~ 0 and 2 ~ 5]
08 2 Found write protection in one or more sectors of PFLASH BANK @
08 2 Found write protection in DFLASH memory
08 2 Debug port and OCDS are not locked
08 1 Time for Connect: 110 ms
08 2 >

Under this condition, it is not possible to touch those protected **DFLASH** sectors. Launching a **MASSERASE D** command would invade those protected areas:



The given suggestion is to use the **DISABLE_PROTECTION D** (remember to provide the right password):

08	2	#TPSTART
08	2	
08	2	#TPCMD CONNECT
08	2	Protocol clock = 25.00 MHz
08	1	Good samples: 5 [Range 0 ~ 0 and 2 ~ 5]
08	2	Found write protection in one or more sectors of PFLASH BANK 0
08	2	Found write protection in DFLASH memory
08	2	Debug port and OCDS are not locked
08	1	Time for Connect: 109 ms
08	2	
08	2	#TPCMD DISABLE_PROTECTION D
08	1	Time for disable protection: 0 ms
08	2	
08	2	#TPCMD MASSERASE D
08	1	Time for Masserase D: 42 ms
08	2	

In this way, it is possible to update the **DFLASH** content even if those protections are set.

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TPCMD CONNECT with a Debug Locked device

When the debug port is protected, the **CONNECT** command will remark it and unlock it if the right password is provided.

08	2	#TPSTART
08	2	
08	2	#TPCMD CONNECT
08	2	Protocol clock = 25.00 MHz
08	1	Good samples: 5 [Range 0 ~ 0 and 2 ~ 5]
08	2	FRB CRC32 check passed.
08	2	FRB Headers collected.
08	2	Found write protection in one or more sectors of PFLASH BANK 0
08	2	Found write protection in DFLASH memory
08	2	Debug port and OCDS are not locked or successfully unlocked 🗲
08	1	Time for Connect: 114 ms
08	12	

If no password is provided:



If a wrong password is provided:



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TPCMD DISABLE_PROTECTION U (only on TC3xx)

When **UCB_BMHDx_ORIG** is locked through the **CC**, its content is protected and FlashRunner 2.0 is able to recognize it during the **CONNECT** command:



If an attempt to restore/reprogram them is executed, without unlocking them, this will be the result:



The given suggestion is to use the **DISABLE_PROTECTION U** with the correct parameters (remember to provide the right password):

```
08 2 ---#TPSTART
08 2 >
08 2 --- #TPCMD CONNECT
08 2 Protocol clock = 25.00 MHz
08|1|Good samples: 4 [Range 2 ~ 5]
08 2 Found protection in UCB_BMHD0 memory
   2 Found protection in UCB_BMHD2 memory
08
08 2 Debug port and OCDS are not locked
08 1 Time for Connect: 109 ms
08 2 >
08 2 --- #TPCMD DISABLE PROTECTION U 0 2 X X
08 1 Time for disable protection: 0 ms
08 2 >
08 2 --- #TPCMD RESTORE_UCB_TC3xx
08 2 UCB_BMHD0 origin sector restored.
08|2|UCB_BMHD1 origin sector restored.
08|2|UCB_BMHD2 origin sector restored.
08|2|UCB_BMHD3 origin sector restored.
08
   2 UCB_BMHD0 copy sector restored.
```

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TPCMD DISABLE_UCB_OTHER U (only on TC3xx)

When **UCB_ECPRIO_ORIG** or **UCB_SWAP_ORIG** or both are locked through the **CC**, their content is protected and FlashRunner 2.0 is able to recognize it during the **CONNECT** command:



If an attempt to restore/reprogram them is executed, without unlocking them, this will be the result:



The given suggestion is to use the **DISABLE_UCB_OTHER U** with the correct parameters (remember to provide the right password):

08	2	#TPSTART
80		
80		#TPCMD CONNECT
80		Protocol clock = 25.00 MHz
80		Good samples: 4 [Range 2 ~ 5]
80		Found protection in UCB_ECPRIO memory
80		Found protection in UCB_SWAP memory
80		Debug port and OCDS are not locked
80		Time for Connect: 109 ms
8 0		
80		#TPCMD DISABLE_UCB_OTHER U S E
80		Time for disable protection: 1 ms
80		
80		#TPCMD RESTORE_UCB_TC3xx
80		UCB_BMHD0 origin sector restored.
80		UCB_BMHD1 origin sector restored.
80		UCB_BMHD2 origin sector restored.
80		UCB_BMHD3 origin sector restored.
80		UCB_BMHD0 copy sector restored.
80		UCB_BMHD1 copy sector restored.
80		UCB_BMHD2 copy sector restored.
80		UCB_BMHD3 copy sector restored.
80		UCB_PFLASH origin sector restored.
80		UCB_DFLASH origin sector restored.
0 8		UCB_DBG origin sector restored.
0 8		UCB_HSM origin sector restored.
0 8		UCB_HSMCOTP0 origin sector restored.
0 8		UCB_HSMCOTP1 origin sector restored.
08		UCB_ECPRIO origin sector restored.

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Most common bricks

1) Enabling the *HSM* boot in the *UCB* related sector, without providing proper booting code to the *PFLASH/DFLASH* area.

The TriCore *Start-up Software (SSW)* will evaluate if the *HSM* boot flag is enabled and check for proper code to boot at the device power up: if nothing is found, the device can be considered bricked since there is no possibility it will work as expected and there is no possibility to recover it.

FlashRunner 2.0 cannot handle this situation, it is customer's responsibility to not make this mistake.

2) Attempting to program a *UCB* sector without providing any data to be programmed at the *CC* locations.

The TriCore *Start-up Software (SSW)* always evaluate if the *CCs* of every *UCB* sectors contain the admitted values; one not admitted value in a *CC* location is enough to consider the device bricked since there is no possibility it will work as expected and there is no possibility to recover it.

This is also the reason why the erase the of the **UCB** memory sector is performed when that sector is actually being programmed. The **ERASE U** command is not available on FlashRunner 2.0 since it will leave the **CC** location in a not admitted state if not programmed after and its availability would be too risky.

<u>FlashRunner 2.0 does not allow the UCB sector to be programmed if it does not find CC data.</u> <u>It is still customer's responsibility to put correct data in those locations.</u>

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FlashRunner 2.0 Connect Flow



As it can be seen from the flowchart above, during the **CONNECT** command, after having powered up the board and having read the IdCode, FR2.0 tries to unlock the device. Three cases are to be considered that could affect this approach:

- 1. A not locked device
- 2. A device with the debug interface locked
- 3. A device with both the debug interface and the OCDS locked

For a better understanding of the user cases that will be shown next, a parameter should be explained, **#TCSETPAR CUSTOM_UNLOCK_TIME** <time>: this setting allows the user to set a custom delay before the unlock process in the **CONNECT** which, in some cases, could potentially minimize the time spent in the **CONNECT**.

The **CUSTOM_UNLOCK_TIME** depends on the customers FW, so it is their responsibility to check for it during a development phase and use it during production to minimize the **CONNECT** command time.

In the *UCB_DBG* there is a register called *PROCONDBG;* based on its value (*0x2* or *0x3*) the *CONNECT* command behaves differently as it will be shown next.

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FlashRunner 2.0 Connect User Cases

For the user cases described below, a **TC397XE-256F300S** evaluation board has been used. These same concepts apply also to **TC2xx** family.

1) Device not locked and *password not provided*:



2) Device not locked and *password provided*:

01 2 000105-16:56:16.435	-#TPUNSETSRC
01 2 000105-16:56:16.435 >	
01 2 000105-16:56:16.435	-#DYNMEMCLEAR
01 2 000105-16:56:16.435 >	
01 2 000105-16:56:16.435	-#TPSETSRC
01 2 000105-16:56:16.435 FR	3 CRC32 = ØxC8D7FABD
01 2 000105-16:56:16.435 >	
01 2 000105-16:56:16.435	-#DYNMEMSET2 0xAF402500 0x20
01 2 000105-16:56:16.435 >	
01 2 000105-16:56:16.435	-#TPSTART
01 2 000105-16:56:16.436 >	
01 2 000105-16:56:16.436	-#TPCMD CONNECT
01 2 000105-16:56:16.537 Pr	otocol clock = 25.00 MHz
01 1 000105-16:56:16.538 Go	od samples: 5 [Range 0 ~ 1 and 3 ~ 5]
01 2 000105-16:56:16.545 De	bug port and OCDS are not locked
01 1 000105-16:56:16.545 Ti	ne for Connect: 110 ms
01 2 000105-16:56:16.545 >	
01 2 000105-16:56:16.545	-#TPCMD DISCONNECT
01 2 000105-16:56:16.545 >	
01 2 000105-16:56:16.545	-#TPEND
01 2 000105-16:56:16.647 >	
01 2 000105-16:56:16.649 3	#1*BIN test.pri

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01	2	000105-14:22:47.786	#TPUNSETSRC
01	2	000105-14:22:47.786	>
01	2	000105-14:22:47.786	#DYNMEMCLEAR
01	2	000105-14:22:47.786	>
01	2	000105-14:22:47.786	#TPSTART
01	2	000105-14:22:47.786	>
01	2	000105-14:22:47.786	#TPCMD CONNECT
01	2	000105-14:22:47.888	Protocol clock = 25.00 MHz
01	1	000105-14:22:47.889	Good samples: 5 [Range 0 ~ 1 and 3 ~ 5]
01	3	000105-14:22:48.095	Debug port is locked. Password not found
01	1	000105-14:22:48.095	Time for Connect: 309 ms
01	2	000105-14:22:48.095	>
01	2	000105-14:22:48.095	#TPCMD DISCONNECT
01	2	000105-14:22:48.095	>
01	2	000105-14:22:48.095	#TPEND
01	2	000105-14:22:48.197	>
01	2	000105-14:22:48.199	> #1*RUN test.prj

3) Device locked (*PROCONDBG* = 0x2) and *no password provided*:

4) Device locked (*PROCONDBG* = 0x2) and wrong password provided:

01 2 000105-16:57:58.225#TPUNSETSRC
01 2 000105-16:57:58.225 >
01 2 000105-16:57:58.225#DYNMEMCLEAR
01 2 000105-16:57:58.226 >
01 2 000105-16:57:58.226#TPSETSRC
01 2 000105-16:57:58.226 FRB CRC32 = 0xC8D7FABD
01 2 000105-16:57:58.226 >
01 2 000105-16:57:58.226#DYNMEMSET2 0xAF402500 0x20
01 2 000105-16:57:58.226 >
01 2 000105-16:57:58.226 #TPSTART
01 2 000105-16:57:58.226 >
01 2 000105-16:57:58.226 #TPCMD CONNECT
01 2 000105-16:57:58.328 Protocol clock = 25.00 MHz
01 1 000105-16:57:58.329 Good samples: 5 [Range 0 ~ 1 and 3 ~ 5]
01 3 000105-16:58:00.875 Debug port is locked. Wrong password
01 1 000105-16:58:00.875 Time for Connect: 2649 ms
01 2 000105-16:58:00.875 >
01 2 000105-16:58:00.875 #TPCMD DISCONNECT
01 2 000105-16:58:00.875 >
01 2 000105-16:58:00.875 #TPEND
01 2 000105-16:58:00.977 >
01 2 000105-16:58:00.978 > #1*BUN test.pri

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→ smh-tech.com Page 20 of 27 info@smh-tech.com

---#TPUNSETSRC 2 000105-17:00:46.383 01 01 2 000105-17:00:46.383 > 01 2 000105-17:00:46.383 ---#DYNMEMCLEAR 01 2 000105-17:00:46.383 > 01 2 000105-17:00:46.383 ---#TPSETSRC 01 2 000105-17:00:46.383 FRB CRC32 = 0xF3F18001 01 2 000105-17:00:46.383 > 01 2 000105-17:00:46.383 ---#TPSTART 01 2 000105-17:00:46.383 > 01 2 000105-17:00:46.383 ---#TPCMD CONNECT 01 2 000105-17:00:46.485 Protocol clock = 25.00 MHz 01 1 000105-17:00:46.486 Good samples: 5 [Range 0 ~ 1 and 3 ~ 5] 01 2 000105-17:00:47.095 CUSTOM_UNLOCK_TIME used: 400 01 2 000105-17:00:47.099 Debug port and OCDS successfully unlocked 01 1 000105-17:00:47.099 Time for Connect: 716 ms 01 2 000105-17:00:47.099 01 2 000105-17:00:47.099 ---#TPCMD DISCONNECT 01 2 000105-17:00:47.099 > 01 2 000105-17:00:47.099 ---#TPEND 01 2 000105-17:00:47.201 > 01 2 000105-17:00:47.202 > #1*RUN test.prj

5) Device locked (*PROCONDBG* = 0x2) and correct password provided:

6) Device locked (PROCONDBG = 0x3) and no password provided:



7) Device locked (*PROCONDBG* = 0x3) and wrong password provided:

01 2 000105-17:06:28.963	#TPUNSETSRC
01 2 000105-17:06:28.963	
01 2 000105-17:06:28.963	#DYNMEMCLEAR
01 2 000105-17:06:28.963	
01 2 000105-17:06:28.963	#TPSETSRC
01 2 000105-17:06:28.963	FRB CRC32 = 0xF3F18001
01 2 000105-17:06:28.963	
01 2 000105-17:06:28.963	#DYNMEMSET2 0xAF402500 0x20
01 2 000105-17:06:28.963	
01 2 000105-17:06:28.963	#TPSTART
01 2 000105-17:06:28.963	
01 2 000105-17:06:28.964	#TPCMD CONNECT
01 2 000105-17:06:29.065	Protocol clock = 25.00 MHz
01 1 000105-17:06:29.066	Good samples: 5 [Range 0 ~ 1 and 3 ~ 5]
01 2 000105-17:06:34.378	
01 4 000105-17:06:34.378	
01 4 000105-17:06:34.379	
01 2 000105-17:06:34.482	00003515!#1"RUN test.prj

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In this particular case, if this procedure is used to effectively test the debug protection with a wrong password during production, the time could be minimized by adding the proper **#TCSETPAR CUSTOM_UNLOCK_TIME**

As it can be noticed in the previous unlocking processes, a proper parameter for this particular case is **400** and the time is reduced from **5s** to **2.5s**:

01 2 000105-17:08:09.344#TPUNSETSRC
01 2 000105-17:08:09.344 >
01 2 000105-17:08:09.344#DYNMEMCLEAR
01 2 000105-17:08:09.345 >
01 2 000105-17:08:09.345 #TPSETSRC
01 2 000105-17:08:09.345 FRB CRC32 = 0xF3F18001
01 2 000105-17:08:09.345 >
01 2 000105-17:08:09.345#DYNMEMSET2 0xAF402500 0x20
01 2 000105-17:08:09.345 >
01 2 000105-17:08:09.345 #TPSTART
01 2 000105-17:08:09.345 >
01 2 000105-17:08:09.345 #TPCMD CONNECT
01 2 000105-17:08:09.447 Protocol clock = 25.00 MHz
01 1 000105-17:08:09.448 Good samples: 5 [Range 0 ~ 1 and 3 ~ 5]
01 2 000105-17:08:11.730 00003515!
01 4 000105-17:08:11.730 01 ERR00003515 Error: halt after reset problem, OCDS could be locked. Wrong password [file
01 4 000105-17:08:11.730 01 ERR00003515 (null) [file/Src/pi-algo.c, line 562, funct cmd TPCMD()]
01/2/000105-17:08:11.834/00003515! #1*RUN test.prj

8) Device locked (*PROCONDBG* = 0x3) and correct password provided:

01	2	000105-17:18:16.095	#TPUNSETSRC
01	2	000105-17:18:16.095	>
01	2	000105-17:18:16.095	#DYNMEMCLEAR
01	2	000105-17:18:16.095	>
01	2	000105-17:18:16.095	#TPSETSRC
01	2	000105-17:18:16.095	FRB CRC32 = 0xF3F18001
01	2	000105-17:18:16.095	>
01	2	000105-17:18:16.095	#TPSTART
01	2	000105-17:18:16.095	>
01	2	000105-17:18:16.095	#TPCMD CONNECT
01	2	000105-17:18:16.197	Protocol clock = 25.00 MHz
01	1	000105-17:18:16.198	Good samples: 5 [Range 0 ~ 1 and 3 ~ 5]
01	2	000105-17:18:16.807	CUSTOM_UNLOCK_TIME used: 400
01	2	000105-17:18:16.811	Debug port and OCDS successfully unlocked
01	1	000105-17:18:16.811	Time for Connect: 716 ms
01	2	000105-17:18:16.811	>
01	2	000105-17:18:16.811	#TPCMD DISCONNECT
01	2	000105-17:18:16.811	>
01	2	000105-17:18:16.811	#TPEND
01	2	000105-17:18:16.913	>
01	2	000105-17:18:16.914	> #1*RUN test.prj

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Also in this last case the time could be minimized from **716ms** to **110ms** by adding the proper **#TCSETPAR CUSTOM_UNLOCK_TIME:**

01	2	000105-17:20:53.548	#TPUNSETSRC
01	2	000105-17:20:53.548	>
01	2	000105-17:20:53.548	#DYNMEMCLEAR
01	2	000105-17:20:53.548	>
01	2	000105-17:20:53.548	#TPSETSRC
01	2	000105-17:20:53.548	FRB CRC32 = 0xF3F18001
01	2	000105-17:20:53.548	
01	2	000105-17:20:53.548	#TPSTART
01	2	000105-17:20:53.548	
01	2	000105-17:20:53.548	#TPCMD CONNECT
01	2	000105-17:20:53.650	Protocol clock = 25.00 MHz
01	1	000105-17:20:53.651	Good samples: 5 [Range 0 ~ 1 and 3 ~ 5]
01	2	000105-17:20:53.654	CUSTOM_UNLOCK_TIME used: 400
01	2	000105-17:20:53.658	Debug port and OCDS successfully unlocked
01	1	000105-17:20:53.658	Time for Connect: 110 ms
01	2	000105-17:20:53.658	>
01	2	000105-17:20:53.658	#TPCMD DISCONNECT
01	2	000105-17:20:53.658	>
01	2	000105-17:20:53.658	#TPEND
01	2	000105-17:20:53.761	>
01	2	000105-17:20:53.762	> #1*RUN test.prj

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Driver Commands

#TPCMD READ_PART_NUMBER: This command is used in specific applications to know the connected part number and choose the right project to run among different ones and does not need a **CONNECT** command to be executed. It prints the result on the terminal with no additional parameters.

#TPCMD CONNECT: This command is used to attach to the target. It detects most of the possible protections set on the device and tries to unlock it, if needed.

#TPCMD MASSERASE F | D: This command is used to completely erase the **PFLASH** or the **DFLASH** memory of the target. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD SECTOR_ERASE F|D <start address> <size>: This command is used to erase specific sectors in the **PFLASH** memory. The minimum size is **16KB.** If there are protections that do not allow thiscommand to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD BLANKCHECK F | D or #TPCMD BLANKCHECK F | D <start address> <size>: This command is used to check if the **PFLASH** or the **DFLASH** memory of the device is blank. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD PROGRAM F|D|U or #TPCMD PROGRAM F <start address> <size>: This command is used to program the *PFLASH* or the *DFLASH* or the *UCB* of the device. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD VERIFY F|D|U R|S or #TPCMD VERIFY F R|S <start address> <size>: This command is used to verify that the content of the **PFLASH** or the **DFLASH** or the **UCB** is correct compared to the data stored inside the customer's firmware. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD VERIFY_MARGIN F|D: This command is used to verify that the content of the **PFLASH** or the **DFLASH** is correct compared to the data stored inside the customer's firmware. This command uses stricts thresholds to read 0s and 1s during the content verification (only for TC3xx).

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→ smh-tech.com Page 24 of 27 info@smh-tech.com #TPCMD READ_REGISTER < register address>: This command is used to read back the 32-bit in the specified register.

#TPCMD RUN <time>: This command is used to execute the customer's firmware programmed inside the target for the specified amount of time.

#TPCMD READ F|D|U <start address> <size>: This command is used to read the content of the **PFLASH** or the **DFLASH** or the **UCB** at the specified address for the specified size; the content is written on the terminal. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD DUMP F|D|U <start address> <size>: This command works as the READ command; the content is written on a file. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD READ_CRC32 <start address> <size>: This command is used to calculate and to print out the **CRC32** of the specified portion of the **PFLASH** or the **DFLASH** or the **UCB**. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD RESTORE_UCB_TC3xx: This command is used to bring the **UCB** memory for **TC3xx** devices back to its default values when possible, thus permanently removing all the protections or settings installed in it. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD RESTORE_UCB_TC2xx: This command is used to bring the **UCB** memory for **TC2xx** devices back to its default values when possible, thus permanently removing all the protections or settings installed in it. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD DISABLE_PROTECTION F|D: This command is used to temporarily disable the protections programmed inside the **UCB_PFLASH** or the **UCB_DFLASH**. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

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→ smh-tech.com Page 25 of 27 info@smh-tech.com #TPCMD DISABLE_PROTECTION U 0 1 2 3: This command is used to temporarily disable the protections on the **UCB_BHMDx**. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD UNLOCK: This command is used to unlock the debug port only when the password is not provided during the **CONNECT** phase and the value programmed inside the **PROCONDBG** is **0x2**.

#TPCMD DISABLE_UCB_OTHER U E S: This command is used to temporarily disable the protections on the **UCB_SWAP or UCB_ECPRIO**. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

#TPCMD VERIFY_PAGE_ERASED <start address> <size>: This command is used to verify that the pages of the **PFLASH (32 bytes)** contained in the specified area are blank. If there are protections that do not allow this command to be executed, there will be a proper feedback given back by the command. Suggestions about what to do could also be printed back on the terminal or the real time log.

Driver Parameters

#TCSETPAR JTAG_PINOUT YES/NO: This parameter is used to perform the **DAP** communication protocol over the **JTAG** connections. The **DAP** protocol is faster, more efficient and more robust compared to the **JTAG**. This parameter is very useful when a **JTAG** fixture is available already in production, but the **DAP** communication protocol needs to be used.

#TCSETPAR PRINT_ON_TERMINAL YES/NO: This command is used to print debug information not only on the real time log, but on the terminal as well. This parameter is very useful when an automatic external programming sequence is implemented on a production line and it needs to parse *FlashRunner 2.0* command feedbacks and take decisions based on them.

#TCSETPAR WD_DUTYCYCLE: This parameter is used to set a duty cycle on the signal generated on *FlashRunner 2.0* DIO6 line.

#TCSETPAR WD_FREQUENCY: This parameter is used to set a frequency on the signal generated on *FlashRunner 2.0* DIO6 line.

The combination of these two parameters is very useful when a watchdog feed is needed to keep a customer's board alive, for example.

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Conclusions

The flashing algorithm can detect many settings enabled on the device and can provide errors or warnings as feedback during the commands execution to prevent users from doing damage to their devices/boards.

Many times resets occur during the flashing process and this could lead *FlashRunner 2.0* to give back bad feedbacks just because the communication with the target has been interrupted.

If a CPS activity has not been asked, it is customer's responsibility to handle the reset sources during the programming of the TriCore devices to avoid bad feedbacks and to avoid SMH – Technologies following a bad lead in case of failures.

In case of failures, it is still customer's responsibility to provide correct and detailed information on the situation.

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