SMH Technologies®

07/08/2024

Driver v. 5.01

Moreno Ortolan

Interfacing FlashRunner 2.0 with GEEHY APM32

SMH Technologies S.r.l.

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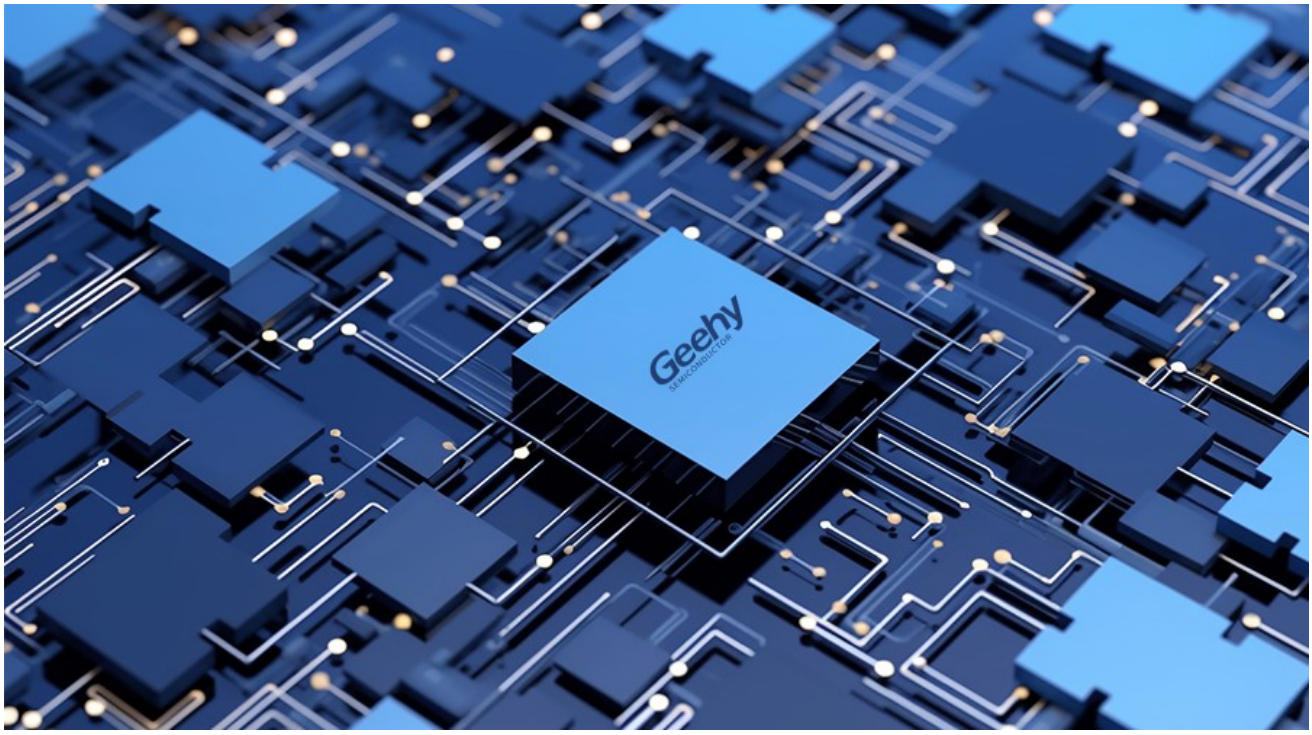
APM32 Introduction

Geehy offers a versatile range of 32-bit microcontrollers and microprocessors equipped with advanced manufacturing processes. These products feature low power consumption, high performance, integration, reliability, and scalability.
Designed for real-time operation, stability, and safety, they cater to diverse customer applications, providing engineers with flexibility and simplicity in design and development.



The APM32 series comprises 32-bit MCUs based on Arm Cortex-M0+/M3/M4F cores.

These MCUs deliver a blend of high performance, low power consumption, real-time capabilities, stability, security, and versatility, ensuring a rapid, straightforward, and flexible development experience.

With diverse models catering to various applications, the APM32 lineup features a robust development ecosystem and finds extensive use in industrial control, automotive electronics, high-end consumer electronics, smart homes, new energy, and communication facilities.

Industrial-Grade MCUs

Elevate automation functionality in industrial systems with enhanced connectivity and applications.

APM32 Motor Control Dedicated MCUs

Configurable for multiple algorithms, providing rich analog features for motor control applications.

APM32A Automotive-Grade MCUs

High-performance MCUs tailored for automotive electronics, ensuring functional safety, integration, and low-power design.

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APM32 Protocols and PIN maps

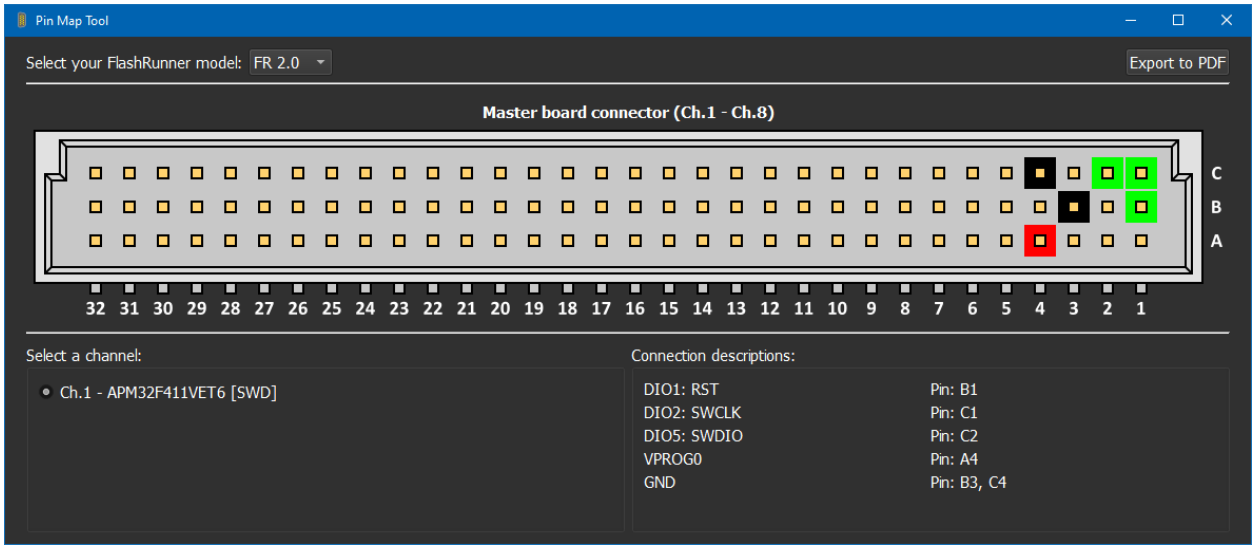
All the APM32 devices support the SWD and JTAG protocol.

You can choose the communication protocol during the Wizard procedure and you can modify it either through the same procedure or manually in the project via the command:

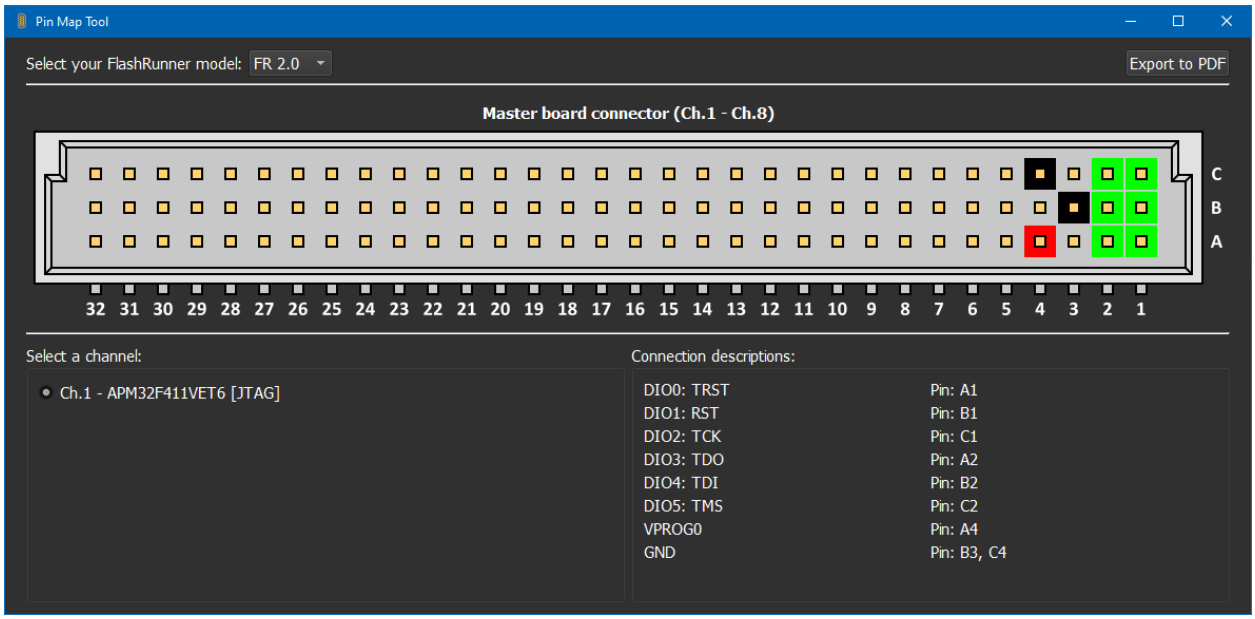
```
#TCSETPAR CMODE <SWD/JTAG>
```

SMH recommend using the SWD protocol because it allows you to use fewer wires for communication.

SWD PIN MAP



JTAG PIN MAP



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APM32 Families

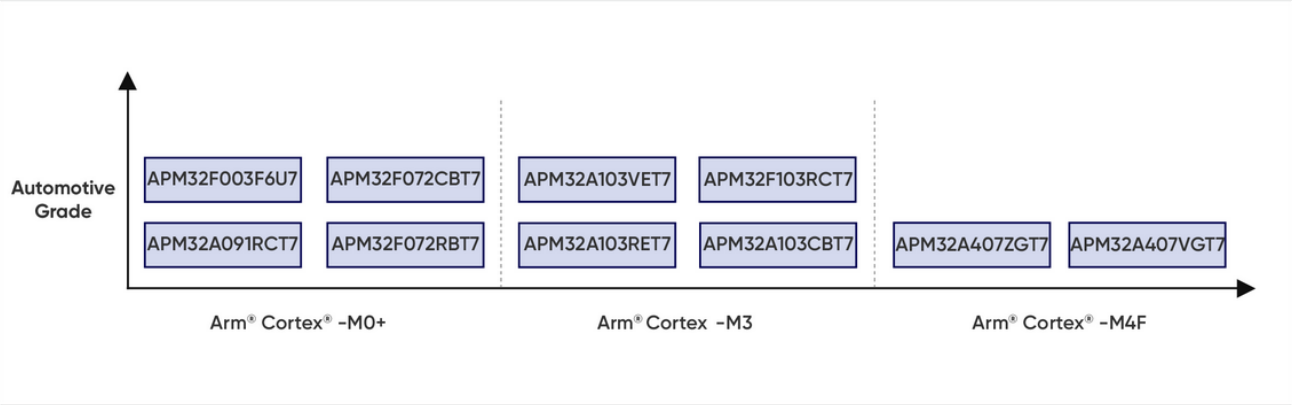
The APM32 family of 32-bit microcontrollers based on the Arm® Cortex®-M processor is divided into three groups and each of these groups are divided into various APM32 series:

APM32 Automotive-Grade MCUs

The APM32A series, including APM32A407, APM32A103, and APM32A091, features six products equipped with Arm® Cortex®-M0+/M3/M4F cores.

These MCUs provide efficient CPU processing, enhanced storage, and robust connectivity.

With AEC-Q100 and ISO 26262 certifications, the APM32A series expands Geehy's automotive-grade MCU lineup, meeting high-reliability standards and accommodating a wide temperature range. It is designed to address diverse communication and body control applications, finding applications in vehicle body control, safety systems, infotainment, power systems, and more.

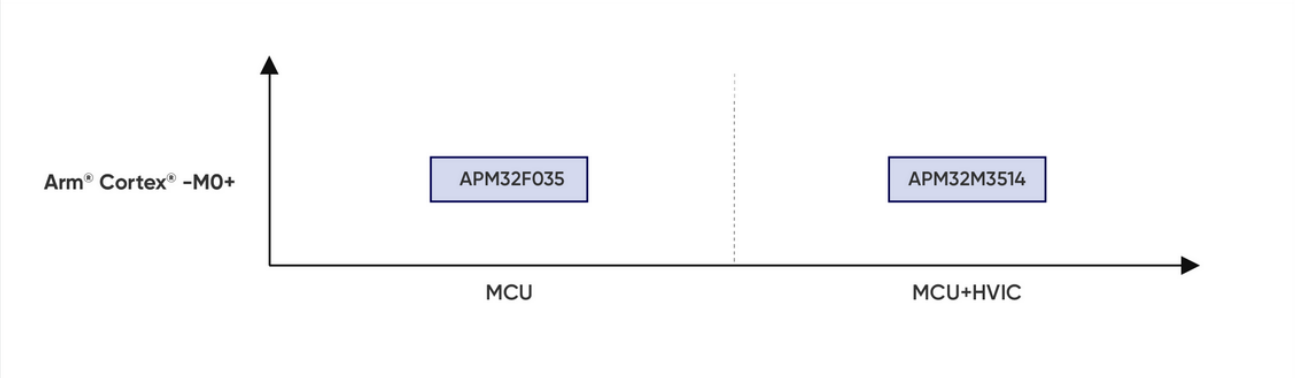


APM32 Motor Control Dedicated MCUs

In an ever-evolving world, motors are becoming increasingly ubiquitous, powering everything from everyday gadgets to industrial giants.

As environmental concerns and automation advancements drive the demand for intelligent, energy-efficient motors, Geehy is at the forefront of innovation, crafting motor control solutions that revolutionize efficiency, minimize power consumption, reduce costs, and elevate safety standards.

Beyond innovation, Geehy excels in enabling swift mass production through state-of-the-art system-level ecosystem services.



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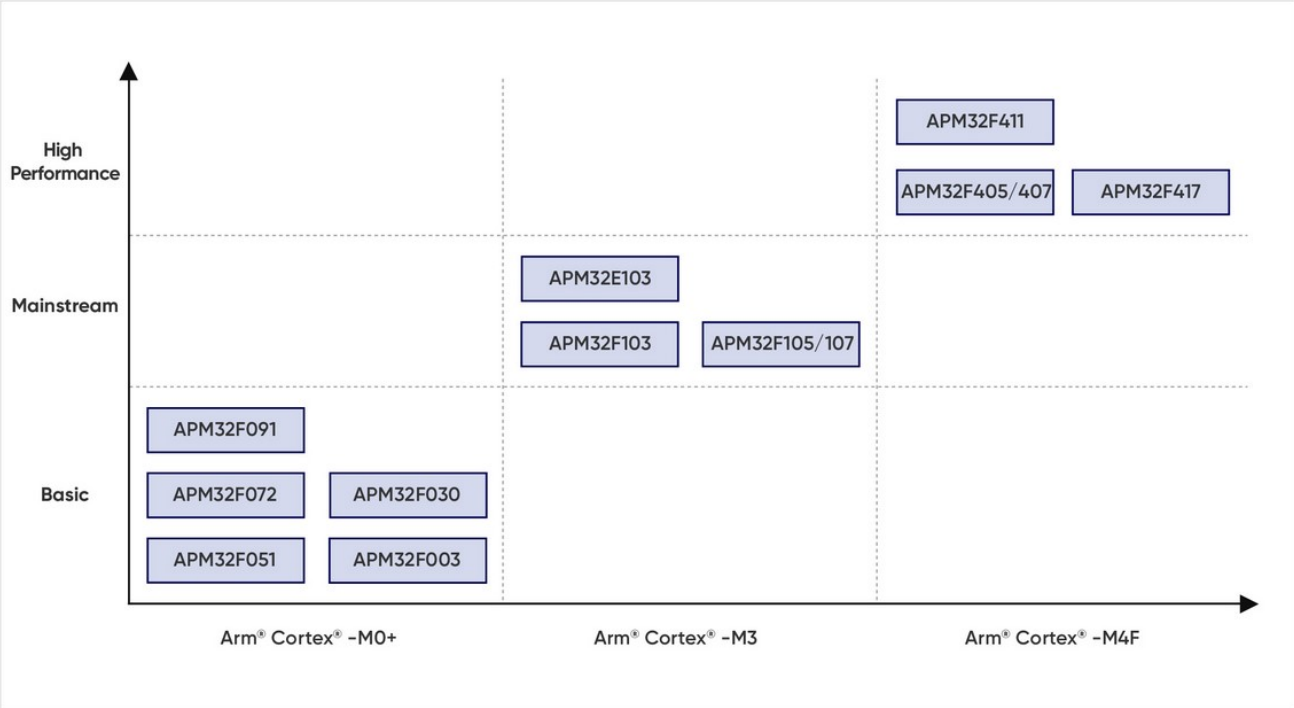
APM32 Industrial-Grade MCUs

The APM32 series comprises 32-bit MCUs based on Arm Cortex-M0+/M3/M4F cores.

These MCUs deliver a blend of high performance, low power consumption, real-time capabilities, stability, security, and versatility, ensuring a rapid, straightforward, and flexible development experience.

With diverse models catering to various applications, the APM32 lineup features a robust development ecosystem and finds extensive use in industrial control, automotive electronics, high-end consumer electronics, smart homes, new energy, and communication facilities.



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APM32 Available Commands

APM32 Industrial-Grade MCUs

APM32E1 Series

MEMORY	MASSERASE	ERASE PAGE	BLANKCHECK	PROGRAM	VERIFY READOUT	VERIFY CHECKSUM	READ	DUMP
Flash [F]	✓	✓	✓	✓	✓	✓	✓	✓
System Memory [S]							✓	✓
Option Bytes [O]				✓	✓		✓	✓

Note: If RDP is set to Level 1, you cannot Read the Option Bytes Area. RDP value to set level 0 is **0xA5**

APM32E1 Additional Commands

Commands for Flash memory:

#TPCMD UNPROTECT
#TPCMD ERASE F [Address] [Size]

Commands for option bytes and RDP protections:

#TPCMD GET_PROTECTION
#TPCMD SET_PROTECTION [Value]
#TPCMD CHECK_PROTECTION [Value]
#TPCMD RESTORE_OPTION_BYTES
#TPCMD OVERVIEW_OPTION_BYTES
#TPCMD WRITE_OPTION_BYTE [Address] [Value]
#TPCMD COMPARE_OPTION_BYTE [Address] [Value]

Commands for device Information:

#TPCMD GET_UNIQUE_ID
#TPCMD GET_FLASH_SIZE
#TPCMD GET_DEVICE_ID
#TPCMD GET_REVISION_ID
#TPCMD GET_DEVICE_INFORMATIONS

Commands for read device memory:

#TPCMD READ_MEM8 [Address] [Byte Count]
#TPCMD READ_MEM16 [Address] [16-bit Word Count]
#TPCMD READ_MEM32 [Address] [32-bit Word Count]

Commands for restart the device:

#TPCMD RUN

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APM32F0 Series

MEMORY	MASSERASE	ERASE PAGE	BLANKCHECK	PROGRAM	VERIFY READOUT	VERIFY CHECKSUM	READ	DUMP
Flash [F]	✓	✓	✓	✓	✓	✓	✓	✓
System Memory [S]							✓	✓
Option Bytes [O]				✓	✓		✓	✓

Note: If RDP is set to Level 1, you cannot Read the Option Bytes Area. RDP value to set level 0 is **0xAA**

APM32F0 Additional Commands

Commands for Flash memory:

#TPCMD UNPROTECT
#TPCMD ERASE F [Address] [Size]

Commands for option bytes and RDP protections:

#TPCMD GET_PROTECTION
#TPCMD SET_PROTECTION [Value]
#TPCMD CHECK_PROTECTION [Value]
#TPCMD RESTORE_OPTION_BYTES
#TPCMD OVERVIEW_OPTION_BYTES
#TPCMD WRITE_OPTION_BYTE [Address] [Value]
#TPCMD COMPARE_OPTION_BYTE [Address] [Value]

Commands for device Information:

#TPCMD GET_UNIQUE_ID
#TPCMD GET_FLASH_SIZE
#TPCMD GET_DEVICE_ID
#TPCMD GET_REVISION_ID
#TPCMD GET_DEVICE_INFORMATIONS

Commands for read device memory:

#TPCMD READ_MEM8 [Address] [Byte Count]
#TPCMD READ_MEM16 [Address] [16-bit Word Count]
#TPCMD READ_MEM32 [Address] [32-bit Word Count]

Commands for restart the device:

#TPCMD RUN

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APM32F1 Series

MEMORY	MASSERASE	ERASE PAGE	BLANKCHECK	PROGRAM	VERIFY READOUT	VERIFY CHECKSUM	READ	DUMP
Flash [F]	✓	✓	✓	✓	✓	✓	✓	✓
System Memory [S]							✓	✓
Option Bytes [O]				✓	✓		✓	✓

Note: If RDP is set to Level 1, you cannot Read the Option Bytes Area. RDP value to set level 0 is **0xA5**

APM32F1 Additional Commands

Commands for Flash memory:

#TPCMD UNPROTECT
#TPCMD ERASE F [Address] [Size]

Commands for option bytes and RDP protections:

#TPCMD GET_PROTECTION
#TPCMD SET_PROTECTION [Value]
#TPCMD CHECK_PROTECTION [Value]
#TPCMD RESTORE_OPTION_BYTES
#TPCMD OVERVIEW_OPTION_BYTES
#TPCMD WRITE_OPTION_BYTE [Address] [Value]
#TPCMD COMPARE_OPTION_BYTE [Address] [Value]

Commands for device Information:

#TPCMD GET_UNIQUE_ID
#TPCMD GET_FLASH_SIZE
#TPCMD GET_DEVICE_ID
#TPCMD GET_REVISION_ID
#TPCMD GET_DEVICE_INFORMATIONS

Commands for read device memory:

#TPCMD READ_MEM8 [Address] [Byte Count]
#TPCMD READ_MEM16 [Address] [16-bit Word Count]
#TPCMD READ_MEM32 [Address] [32-bit Word Count]

Commands for restart the device:

#TPCMD RUN

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APM32F4 Series

MEMORY	MASSERASE	ERASE PAGE	BLANKCHECK	PROGRAM	VERIFY READOUT	VERIFY CHECKSUM	READ	DUMP
Flash [F]	✓	✓	✓	✓	✓	✓	✓	✓
OTP Area [T]			✓	✓	✓	✓	✓	✓
System Memory [S]							✓	✓
Option Bytes [O]				✓	✓		✓	✓

Note: If the RDP is set to Level 1, you cannot Read the Option Bytes Area

APM32F4 Additional Commands

Commands for Flash memory:

#TPCMD UNPROTECT
#TPCMD ERASE F [Address] [Size]

Commands for option bytes and RDP protections:

#TPCMD GET_PROTECTION
#TPCMD SET_PROTECTION [Value]
#TPCMD CHECK_PROTECTION [Value]
#TPCMD RESTORE_OPTION_BYTES
#TPCMD OVERVIEW_OPTION_BYTES
#TPCMD WRITE_OPTION_BYTE [Address] [Value]
#TPCMD COMPARE_OPTION_BYTE [Address] [Value]

Commands for device Information:

#TPCMD GET_UNIQUE_ID
#TPCMD GET_FLASH_SIZE
#TPCMD GET_DEVICE_ID
#TPCMD GET_REVISION_ID
#TPCMD GET_DEVICE_INFORMATIONS

Commands for read device memory:

#TPCMD READ_MEM8 [Address] [Byte Count]
#TPCMD READ_MEM16 [Address] [16-bit Word Count]
#TPCMD READ_MEM32 [Address] [32-bit Word Count]

Commands for restart the device:

#TPCMD RUN

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APM32 Driver Commands

APM32 Standard Commands

Here you can find the complete list of all available commands for APM32 driver.

```
Memory type:

F → FLASH
O → OPTION BYTES
T → OTP AREA
S → SYSTEM MEMORY (Read Only)
```

#TPCMD CONNECT

#TPCMD CONNECT

This function performs the entry and is the first command to be executed when starting the communication with the device.

Example for APM32F4 series:

```
---#TPCMD CONNECT
Protocol selected SWD.
Entry Clock is 4.00 MHz.
Trying Hot Plug connect procedure.
IDCODE: 0x2BA01477.
Designer: 0x23B, Part Number: 0xBA01, Version: 0x2.
ID-Code read correctly at 4.00 MHz.
JTAG-SWD Debug Port enabled.
Scanning AP map to find all APs.
AP[0] IDR: 0x24770011, Type: AMBA AHB3 bus.
AP[0] ROM table base address 0xE00FF000.
CPUID: 0x410FC241.
Implementer Code: 0x41 - [ARM].
Found Cortex M4 revision r0p1.
Program counter value is 0x0800019C.
Valid Program Counter found into Flash Memory. Forcing software breakpoint.
Breakpoint software used correctly. Program Counter value is 0x0800019C.
Cortex M4 Core halted [0.013 s].
Device configuration: [0x0FFFAAED]
 * The device's Readout Protection level is 0 [0xAA].
 * BOR off (VBOR0), voltage range: 1.8V-2.1V.
 * Software independent watchdog selected.
 * No reset generated when entering the Stop mode.
 * No reset generated when entering the Standby mode.
PLL enabled using internal HSI oscillator.
Requested Clock is 37.50 MHz.
Generated Clock is 37.50 MHz.
Good samples: 4 [Range 4-7].
IDCODE: 0x2BA01477.
Designer: 0x23B, Part Number: 0xBA01, Version: 0x2.
ID-Code read correctly at 37.50 MHz.
Time for Connect: 0.120 s.
>|
```

#TPCMD MASSERASE

#TPCMD MASSERASE <F>

Masserase command is available for Flash memory.
This function performs a masserase of Flash memory.

#TPCMD ERASE

#TPCMD ERASE <F>

Erase is available for Flash memory.
This function performs a page/sector erase of the entire Flash memory.

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#TPCMD ERASE <F> <start address> <size>
Erase is available for Flash memory.
This function performs a page/sector erase of Flash memory.
Enter the Start Address and Size in hexadecimal format.

#TPCMD BLANKCHECK

#TPCMD BLANKCHECK <F|T>
Blankcheck is available for Flash or OTP memory.
Verify if all memory is erased.

#TPCMD BLANKCHECK <F|T> <start address> <size>
Blankcheck is available for Flash or OTP memory.
Verify if selected part of memory is erased.
Enter the Start Address and Size in hexadecimal format.

#TPCMD PROGRAM

#TPCMD PROGRAM <F|T|O>
Program is available for Flash, OTP or Option Bytes memory.
Programs all memory of the selected type based on the data in the FRB file.

#TPCMD PROGRAM <F|T|O> <start address> <size>
Program is available for Flash, OTP or Option Bytes memory.
Programs selected part of memory of the selected type based on the data in the FRB file.
Enter the Start Address and Size in hexadecimal format.

#TPCMD VERIFY

#TPCMD VERIFY <F|T|O> <R>
R: Readout Mode.
Verify Readout is available for Flash, OTP or Option Bytes memory.
Verify all memory of the selected type based on the data in the FRB file.

#TPCMD VERIFY <F|T|O> <R> <start address> <size>
R: Readout Mode.
Verify Readout is available for Flash, OTP or Option Bytes memory.
Verify selected part of memory of the selected type based on the data in the FRB file.
Enter the Start Address and Size in hexadecimal format.

#TPCMD VERIFY <F|T> <S>
S: Checksum 32 Bit Mode.
Verify Checksum is available for Flash or OTP memory.
Verify all memory of the selected type based on the data in the FRB file.

#TPCMD VERIFY <F|T> <S> <start address> <size>
S: Checksum 32 Bit Mode.
Verify Checksum is available for Flash or OTP memory.
Verify selected part of memory based on the data in the FRB file.
Enter the Start Address and Size in hexadecimal format.

#TPCMD READ

#TPCMD READ <F|T|O|S>
Read is available for all memories.
Read all memory of selected type.
The result of the read command will be visible into the Terminal.

#TPCMD READ <F|T|O|S> <start address> <size>
Read is available for all memories.

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Read selected part of memory of the selected type.
The result of the read command will be visible into the Terminal.

#TPCMD DUMP

```
#TPCMD DUMP <F|T|O|S>
```
Dump is available for all memories.
Dump all memory of selected type.
The result of the dump command will be stored in the FlashRunner 2.0 internal memory.

```
#TPCMD DUMP <F|T|O|S> <start address> <size>
```
Dump is available for all memories.
Dump selected part of memory of the selected type.
The result of the dump command will be stored in the FlashRunner 2.0 internal memory.

#TPCMD DISCONNECT

```
#TPCMD DISCONNECT
```
Disconnect function. Power off and exit.

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APM32 Additional Commands

The additional commands are specific commands that perform particular functions such as, for example, they allow easier management of the Option Bytes, RDP protections, Permission Levels, etc.

They also allow you to perform complex procedures with a simple single command and allow you to obtain important information from the device.

Typically, all additional commands are available in the last section of the Graphical User Interface when creating a project.

It is possible to see the specific commands assigned to the specific APM32 series in the chapter Available operations for family.

Additional Commands for RDP Management

These commands are used to modify, check or get the RDP (Readout Protection) level from/to target APM32 device.

#TPCMD SET_PROTECTION

Syntax: `#TPCMD SET_PROTECTION <RDP value>`

`<RDP value>` RDP level in HEX format [0x00 - 0xFF] (i.e., 0xBB)

Prerequisites: none

Description: This command sets the RDP value into target device
Specific Option Byte is modified only in the appropriate RDP section

Note: The RDP level 0 is **0xAA** for all devices except for **APM32F1 and APM32E1** where level 0 is **0xA5**
The RDP level 2 is **0xCC**
The RDP level 1 is for all values excepted the above

When RDP level 1 is active, programming the RDP to level 0 causes the Flash memory to be mass-erased
When RDP level 2 is active, JTAG/SWD port is forever disabled

Examples: Correct command execution: 😊

```
---#TPCMD SET_PROTECTION 0xBB
Time for Set Protection: 0.058 s
```

Now if you try to reconnect to target device you can see that RDP value is changed to 1.

```
* The device's RDP level is 1 [0xBB].
```

Wrong command execution for RDP value **0xCC**: ☹

To avoid setting the RDP level 2 by mistake, if the command `#TPCMD SET_PROTECTION` receives the value **0xCC** as input, it will respond with this error:

```
---#TPCMD SET_PROTECTION 0xCC
═══════════════════════════════════════════════════════════ *** WARNING *** ═══════════════════════════════════════════════════════════
Are you sure to set Readout Protection Level to 0xCC?.
Level 2: Enabled debug/chip read protection.
 - All protections provided by Level 1 are active.
 - Booting from system memory is not allowed anymore.
 - JTAG, SWD, SWV (single-wire viewer) are disabled.
 - User option bytes can no longer be changed.
 - When booting from Flash memory, accesses to Flash memory and backup SRAM from user code are allowed.
Memory read protection Level 2 is an irreversible operation.
When Level 2 is activated, the level of protection cannot be decreased to Level 0 or Level 1.
The JTAG port is permanently disabled when Level 2 is active (acting as a JTAG fuse).
As a consequence, boundary scan cannot be performed.
If you are sure to set RDP to 0xCC, please use this command syntax: \" #TPCMD SET_PROTECTION 0xCC Y \".
═══════════════════════════════════════════════════════════════════════════════════════════════════════════════════════════════
```

Correct command execution for RDP value **0xCC**: 😊

If you are sure to set RDP to 0xCC, please use this command syntax: `#TPCMD SET_PROTECTION 0xCC Y`

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```
---#TPCMD SET_PROTECTION 0xCC Y
Time for Set Protection: 0.058 s
```

#TPCMD GET_PROTECTION

Syntax: #TPCMD GET_PROTECTION

Prerequisites: none

Description: This command gets and return the RDP value from target device

Note: none

Examples: Correct command execution: 😊

```
---#TPCMD GET_PROTECTION
RDP level: 0xAA.
Readout Protection Level 0.
Time for Get Protection: 0.001 s
```

#TPCMD CHECK_PROTECTION [Value]

Syntax: #TPCMD CHECK_PROTECTION <RDP level>

<RDP level> RDP level in decimal format [0, 1, 2]

Prerequisites: none

Description: This command checks the RDP value from target device and fails if inserted value is different from device RDP value

Note: none

Examples: Correct command execution: 😊

```
---#TPCMD CHECK_PROTECTION 0
Time for Check Protection: 0.001 s
```

Wrong command execution: ☹

```
---#TPCMD CHECK_PROTECTION 1
Request Readout Protection Level is 1.
The device's Readout Protection Level is 0.
Error!
```


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Additional Commands for Option Bytes Management

These commands are used to change, verify or get option bytes from/to target APM32 device.
They are available for all APM32 devices.

#TPCMD RESTORE_OPTION_BYTES

Syntax: `#TPCMD RESTORE_OPTION_BYTES`

Prerequisites: none

Description: This command is used to restore Option Bytes to a default value, when they are in a not good condition, due for example to an incorrect device configuration

With this command, as you can guess from the name itself, it is possible to return the Option Bytes to the default state (when this operation is possible)

The Default value of the Option Bytes is often the one present when the device leaves the factory

More precisely, in the various Reference Manuals you can find the various default values for each APM32 family and subfamily

Note: Please be careful when Readout Protection Level is set to 1. If you use the `#TPCMD RESTORE_OPTION_BYTES` you automatically perform a masserase of the entire Flash memory

Examples: Correct command execution: 😊

```
---#TPCMD RESTORE_OPTION_BYTES
Time for Restore Option Bytes: 0.023 s
```

#TPCMD OVERVIEW_OPTION_BYTES

Syntax: `#TPCMD OVERVIEW_OPTION_BYTES`

Prerequisites: none

Description: Reads all option bytes present in the device and represents these values in a table in the Real Time Log.

Note: none

Examples: Correct command execution: 😊

```
---#TPCMD OVERVIEW_OPTION_BYTES

  0x1FFFC000 written by FLASH_OPTCTRL[15:00]
  [0101|0101|0000|0000|1010|1010|1111|1111]
  Hex: 0x5500AAFF
  ╔═══════╦══════════════════╦════════╗
  ║ Bits: ║ Name:            ║ Value: ║
  ╠═══════╬══════════════════╬════════╣
  ║ [15:08]  RPROT           ║ AA     ║
  ║   [07]   RSTSTDB         ║ 1      ║
  ║   [06]   RSTSTOP         ║ 1      ║
  ║   [05]   WDTSEL          ║ 1      ║
  ║ [03:02]  BORLVL          ║ 3      ║
  ╚═══════╩══════════════════╩════════╝

  0x1FFFC008 written by FLASH_OPTCTRL[31:16]
  [0000|0000|0000|0000|1111|1111|1111|1111]
  Hex: 0x0000FFFF
  ╔═══════╦══════════════════╦════════╗
  ║ Bits: ║ Name:            ║ Value: ║
  ╠═══════╬══════════════════╬════════╣
  ║ [11:00]  NWPROT          ║ FFF    ║
  ╚═══════╩══════════════════╩════════╝

  ...
```


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```
Time for Overview Option Bytes: 0.003 s.
>|
```

#TPCMD WRITE_OPTION_BYTE [Address] [Value]

Syntax: `#TPCMD WRITE_OPTION_BYTE <Address> <Value>`

<Address>	Address in HEX format (i.e., 0x1FFFC000)
<Value>	Value in HEX format (i.e., 0x5500AAFF)

Prerequisites: none

Description: Writes the Option Byte to the selected address (Address) with the entered value (Value).
The reserved bits of the Option Bytes are not changed.

Note: Be careful not to set the Readout Protection Level to 0xCC (level 2) by mistake.

Examples: Correct command execution: 😊

```
---#TPCMD WRITE_OPTION_BYTE 0x1FFFC000 0x5500AAFF
Time for Write Option Byte: 0.004 s
```

#TPCMD COMPARE_OPTION_BYTE [Address] [Value]

Syntax: `#TPCMD COMPARE_OPTION_BYTE <Address> <Value>`

<Address>	Address in HEX format (i.e., 0x1FFFC000)
<Value>	Value in HEX format (i.e., 0x5500AAFF)

Prerequisites: none

Description: Writes the Option Byte to the selected address (Address) with the entered value (Value).
The reserved bits of the Option Bytes are not changed.

Note: Be careful not to set the Readout Protection Level to 0xCC (level 2) by mistake.

Examples: Correct command execution: 😊

```
---#TPCMD COMPARE_OPTION_BYTE 0x1FFFC000 0x5500AAFF
Time for Compare Option Byte: 0.001 s
```

Wrong command execution: ☹

```
---#TPCMD COMPARE_OPTION_BYTE 0x1FFFC000 0x5500AAFF
Address: 0x1FFFC000, Option Byte Read: 0x5500BBFF, Expected: 0x5500AAFF.
Error!
```


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Additional Commands for Device Informations

These commands are used to get specific information from target APM32 device.
All of these commands print into Terminal and into Real Time Log.
They are available for all APM32 devices.

#TPCMD GET_UNIQUE_ID

Syntax: `#TPCMD GET_UNIQUE_ID`

Prerequisites: none

Description: Get Unique ID from target APM32 and print it into Terminal and Real Time Log

Note: This command prints into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD GET_UNIQUE_ID
Unique ID: 4341575737000020001900 2E.
Time for Get Unique ID: 0.001 s
```

#TPCMD GET_FLASH_SIZE

Syntax: `#TPCMD GET_FLASH_SIZE`

Prerequisites: none

Description: Get Flash Size from target APM32 and print it into Terminal and Real Time Log

Note: This command prints into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD GET_FLASH_SIZE
Flash Size: 0x0400 - 1024 KB.
Time for Get Flash Size: 0.001 s
```

#TPCMD GET_PACKAGE_ID

Syntax: `#TPCMD GET_PACKAGE_ID`

Prerequisites: none

Description: Get Package ID from target APM32 and print it into Terminal and Real Time Log

Note: This command prints into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD GET_PACKAGE_ID
Package Type: 0x01.
Time for Get Package ID: 0.001 s
```


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#TPCMD GET_DEVICE_ID

Syntax: `#TPCMD GET_DEVICE_ID`

Prerequisites: none

Description: Get Device ID from target APM32 and print it into Terminal and Real Time Log

Note: This command prints into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD GET_DEVICE_ID
Device ID: 0x413.
Time for Get Device ID: 0.001 s
```

#TPCMD GET_REVISION_ID

Syntax: `#TPCMD GET_REVISION_ID`

Prerequisites: none

Description: Get Revision ID from target APM32 and print it into Terminal and Real Time Log

Note: This command prints into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD GET_REVISION_ID
Revision ID: 0x1003 - Rev Y.
Time for Get Revision ID: 0.001 s
```

#TPCMD GET_DEVICE_INFORMATIONS

Syntax: `#TPCMD GET_DEVICE_INFORMATIONS`

Prerequisites: none

Description: Get Device Informations from target APM32 and print it into Terminal and Real Time Log

Note: This command prints into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD GET_DEVICE_INFORMATIONS
Unique ID: 434157573700002000190002E.
X and Y Wafer: 0x0019002E.
Wafer number: 0x20.
Lot number: 0x43415757370000.
Flash Size: 0x0400 - 1024 KB.
Device ID: 0x413.
Revision ID: 0x1003 - Rev Y.
Time for Get Device Informations: 0.002 s
```


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Additional Commands for Device Execution

#TPCMD RUN

Syntax: `#TPCMD RUN <Time [s]>`

<Time [s]>	Time in seconds (i.e., 2 s). This time is an optional parameter.

Prerequisites: none

Description: Move the Reset line up and down quickly if no parameter <Time [s]> is inserted.
`#TPCMD RUN <Time [s]>` instead moves the Reset line down and high, waits for the entered time.
This command typically can be used to execute the firmware programmed in the device.

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APM32 Additional Commands for Flash Memory

These commands are used to perform some specific operation into APM32 Flash memory.

#TPCMD UNPROTECT

Syntax: `#TPCMD UNPROTECT`

Prerequisites: none

Description: Remove the Flash write protected sectors and perform a Masserase F of all Flash memory
If there are no write protected sectors in the flash memory, then a standard Masserase F is performed
Available for all APM32 Devices

Note: none

Examples: Correct command execution: 😊

```
---#TPCMD UNPROTECT
Some sectors of Flash Memory are Write Protected.
Removing Write Protected sectors protection.
Readout Protection level is 1. Option Bytes Masserase.
Time for Unprotect: 7.324 s
```

#TPCMD ERASE F [Address] [Size]

Syntax: `#TPCMD ERASE F <Address> <Size>`

<Address> Address in HEX format (i.e., 0x08000000)
<Size> Size in HEX format (i.e., 0x2000)

Prerequisites: none

Description: Erase all memory with Page/Sector erase.
With this command, a Page/Sector Erase of the device FLASH memory will be performed..
Typically running the Page Erase of the entire Flash memory takes much longer than running the Masserase command.

If the Readout Protection Level (RDP) isn't set at level 0, an error will be returned.

Available for all APM32 Devices

Note: Erase command isn't available for Option Bytes Area and OTP Area

Examples: Correct command execution: 😊

```
---#TPCMD ERASE F 0x08000000 0x2000
Time for Erase F: 0.863 s.
```


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APM32 Additional Commands for Read Device Memory

These commands are used to read data from target APM32 device.
All of these commands print into Terminal and into Real Time Log.

#TPCMD READ_MEM8 [Address] [Byte Count]

Syntax: `#TPCMD READ_MEM8 <Address> <Byte Count>`

<Address> Address in HEX format (i.e., 0x52002020)
<Byte Count> Byte count in decimal format (i.e., 8 -> eight bytes)

Prerequisites: none

Description: Read memory byte per byte from target APM32 and print it into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD READ_MEM8 0x52002020 8
Read[0x52002020]: 0xF0
Read[0x52002021]: 0xAA
Read[0x52002022]: 0x16
Read[0x52002023]: 0x14
Read[0x52002024]: 0x00
Read[0x52002025]: 0x00
Read[0x52002026]: 0x00
Read[0x52002027]: 0x00
Time for Read Mem: 0.002 s
```

#TPCMD READ_MEM16 [Address] [16-bit Word Count]

Syntax: `#TPCMD READ_MEM16 <Address> <16-bit Word Count>`

<Address> Address in HEX format (i.e., 0x52002020)
<16-bit Word Count> 16-bit Word count in decimal format (i.e., 4 -> four 16-bit words)

Prerequisites: none

Description: Read memory 16-bit word per 16-bit word from target APM32 and print it into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD READ_MEM16 0x52002020 4
Read[0x52002020]: 0xAAF0
Read[0x52002022]: 0x1416
Read[0x52002024]: 0x0000
Read[0x52002026]: 0x0000
Time for Read Mem: 0.002 s
```

#TPCMD READ_MEM32 [Address] [32-bit Word Count]

Syntax: `#TPCMD READ_MEM32 <Address> <32-bit Word Count>`

<Address> Address in HEX format (i.e., 0x52002020)
<32-bit Word Count> 32-bit Word count in decimal format (i.e., 2 -> two 32-bit words)

Prerequisites: none

Description: Read memory 32-bit word per 32-bit word from target APM32 and print it into Terminal and Real Time Log

Examples: Correct command execution: 😊

```
---#TPCMD READ_MEM32 0x52002020 2
Read[0x52002020]: 0x1416AAF0
Read[0x52002024]: 0x00000000
Time for Read Mem: 0.002 s
```


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APM32 Driver Parameters

The additional parameters are used to configure some specific option inside APM32 driver.

APM32 Standard Additional Parameters:

#TCSETPAR ENTRY_CLOCK

Syntax: `#TCSETPAR ENTRY_CLOCK <Frequency>`

`<Frequency>` Accepted parameters 4000000, 2000000, 1000000, 500000, 100000 Hz

Description: Set the JTAG/SWD frequency used into Connect procedure before raising the PLL of the device, if device PLL is available

Note: Default value 4.00 MHz

#TCSETPAR PLL_ENABLED

Syntax: `#TCSETPAR PLL_ENABLED <Value>`

`<Value>` Accepted parameters YES / NO

Description: Enable the PLL of the device at the highest possible frequency if it's available using HSI oscillator

Note: Default value YES

#TCSETPAR RESET_HARDWARE

Syntax: `#TCSETPAR RESET_HARDWARE <Value>`

`<Value>` Accepted parameters YES / NO

Description: Use Hardware reset (DIO1) into Connect procedure during halt Cortex Core
Please leave this parameter to NO except when it is strictly necessary
Usually, the Software Reset is enough to proceed with the reset of the device and to continue with the programming procedure

Note: Default value NO

#TCSETPAR SAMPLING_POINT

Syntax: `#TCSETPAR SAMPLING_POINT <Value>`

`<Value>` Accepted values are in the range 1-15

Description: Use this parameter to permanently set the sampling point of the FPGA
It is recommended to leave this parameter with the default value

Note: Default value 17

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APM32 Driver Changelog

Info about driver version 5.00 – 27/05/2024
First official version of APM32 driver for GEEHY APM32xx devices.

Info about driver version 5.01 – 07/08/2024
Supported APM32F0x series of GEEHY AMP32 devices.

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