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FLEXMod

Boot Loader

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Firmware version 1.05

FLEXMod 1.4

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1. FLEXMod Boot Loader

The FLEXMod Boot Loader is a new firmware that can:

- Handle a multi-firmware setup (DVB-T, DVB-S and DVB-C, for example) with the possibility to select the required firmware every boot using always the same procedure instead of having to issue different commands, depending upon the currently running firmware
- Perform firmware upgrades in a fail-safe manner. Since the Boot Loader firmware can be used to upgrade all the other firmwares, in case of problem, the Boot Loader firmware itself will still be functional and can be used to re-issue the upgrade
- Upload new bitstreams faster and in more reliable way. Now the Boot Loader supports higher bitrates and the XMODEM-CRC or XMODEM-1K protocols.

2. Connectors and pin description

The Boot Loader software does not use any I/O pin of the FLEXMod module except for the TxD/RxD lines and the power supply pins.

Please refer to the documentation of the FLEXMod firmware you are using for a complete pin description.

3. Serial port usage

The Rs232 serial port allows the configuration and the operation of the FLEXMod Boot Loader. This serial port normally operates at 115200 bps, 8 data bits, 1 stop bit, no parity but the operating baud rate can be changed using the *Baud* command. Regardless of the setting done with the *Baud* command, the FLEXMod-Boot Loader will always boot using a baud rate of 115200.

Differently from other FLEXMod firmwares, the Boot Loader will not boot directly into the command interpreter.

In the normal booting sequence, the Boot Loader will display a Copyright message, several dots and then it will optionally boot the selected firmware (DVB-T, DVB-S, FLEXMod-AV...) (See the *BootSelect* command on page 10)

If an ENTER (CR, 0x0D) character is received while displaying the dots, the boot process will be aborted with a specific message (“*Autoboot stopped, press "Enter" to continue*”).

Pressing ENTER again will display the CopyRight message for a second time, followed by the standard command prompt.

It is now possible to enter commands.

Most of the command used to set values with one or more parameters, returns the current configured value if issued without any parameter.

This serial port normally echoes the characters received back to the terminal. When this is not desirable (for example because you are using a microcontroller), echoing can be disabled using the CTRL-O special character.

Operating mode can be changed at any time by sending one or more of the following characters.

Character	ASCII	Operating mode
CTRL-E	0x05	Echo ON. Enables echoing of characters back to the terminal and shows a command prompt. This setting simplifies the use of a terminal emulation software.
CTRL-O	0x0F	Echo OFF. Disables echoing of characters and command prompt. This operating mode simplifies the software in a microcontroller since it does not require the processing of unnecessary characters.
CTRL-D	0x04	Decimal answers. Every protocol command giving a numeric answer will return a decimal number by using the minimum number of characters needed. Leading zeroes are omitted.
CTRL-X	0x18	Hexadecimal answers. Every protocol command giving a numeric answer will return a hexadecimal number by using the fixed number of characters specified in the command description.

BOLD indicates default values.

Other special functions characters/keys are:

Key	Function
ESC (twice)	Aborts current command editing.
BackSpace	Deletes characters.
TAB	Complete/Help key. If the text entered is not a complete command word, this key shows a list of all the commands that begin with the entered text; if the text entered is a complete command word, the system will display a brief explanation of this command.
CR (Enter)	Executes the command.

A list of available commands can be obtained using the *HELP* command.

3.1. HELP

Used for: FLEXMod Help.

Parameters: None

Example: Help ↵

Notes: The output consist of severel pages. Press any key to change page.

4. Image loading and selection

FLEXMod-AV series modules requires a larger firmware compared to other FLEXMods, so the number of firmwares that can be loaded on a FLEXMod module depends on the kind of firmware used. It is not possible to mix FLEXMod-AV and not FLEXMod-AV firmwares on the same module.

The Boot Loader can handle 4 (FLEXMod-AV series) or 5 images (other FLEXMods). Image 0 is always used by the Boot Loader. The remaining images (3 or 4) can be used to load standard FLEXMod firmwares.

FLEXMods with a factory installed Boot Loader will already be formatted with a suitable partitioning depending on the installed firmware. If you are installing the Boot Loader on a module for the first time or if you are repurposing a FLEXMod module from a FLEXMod-AV firmware to a non FLEXMod-AV firmware or vice versa, you have to use the FlashFormat command (see below) to change the partitioning schema to the type required.

Note that older/not yet upgraded FLEXMod firmwares are not aware of the presence of the Boot Loader. In these cases, be aware that a FlashFormat command issued within these firmwares will erase the Boot Loader itself.

4.1. FlashFormat

Used for: Erase and repartition the FPGA boot Flash except for the BootManager.
 Parameters: Password (741963), Partition Size (1,2)
 Example: FlashFormat 741963,1↵ *(1.6 Mbytes partition size/FLEXMod)*
 FlashFormat 741963,2↵ *(2.0 Mbytes partition size/FLEXMod-AV)*
 Notes: FLEXMod-AV series requires a 2.0 Mbytes partition size, while all the other FLEXMod series uses the 1.6 Mbytes partition size.

4.2. EraseBitstream

Used for: Remove a bitstream from the Flash memory.
 Parameters: Password (741963) [, Bitstream Number]
 Example: EraseBitstream 741963,1↵ *(Erase bitstream #1)*
 Notes: If the Bitstream Number is not given, an interactive selection screen will be shown.

4.3. LoadBitstream

Used for: Upload a FLEXMod or FLEXMod-AV firmware to flash.
 Parameters: Password (741963), BitStreamNumber, ImageName [, CRC, PreACK]
 Example: LoadBitstream 741963,1,FLEXMod 111↵ *(Xmodem upload of image #1)*
 LoadBitstream 741963,2,AV101,1 *(Xmodem-CRC upload of image #2)*

Notes: The image name is used to describe the firmware during boot and for the *BootSelect* command. Any text can be used. It can be later changed using the *RenameBitstream* command.

At the end of the upload a report will be displayed, indicating the number of errors occurred during the firmware upload, the file and the flash CRC.

The upload can be done either using Xmodem or Xmodem-1K. The Boot Loader will automatically detect and use the correct protocol. The upload is normally done using Xmodem (or Xmodem-1K) Checksum. Xmodem-CRC (or Xmodem-1K-CRC) can be optionally used by specifying the optional parameter CRC on the command line.

The PreACK option will speed up the transfer by spoofing the ACK reply in advance but this will prevent the possibility to retransmit a bad block, requiring an abort in case of error.

4.4. RenameBitstream

Used for: Change the name of the selected bitstream.

Parameters: None

Example: `RenameBitstream ↵`

Notes: This command has no parameters since the rename operation can only be done interactively

4.5. BootSelect

Used for: Boot the FPGA from the selected Bitstream.

Parameters: [Image to Boot]

Example: `BootSelect ↵` (*Shows an interactive screen to select the image to boot*)
`BootSelect 1↵` (*Boots image 1*)

Notes: You can select image 0 as the image to boot. In this case the Boot Loader will NOT automatically boot any additional image. The FLEXMod will stop after the copyright message and the dots.

4.6. SaveBitstream

Used for: Backup a firmware from the Flash memory to a PC.

Parameters: None

Example: `SaveBitstream ↵`

Notes: The bitstream to be saved will be chosen with an interactive screen. The protocol used will be either Xmodem-1K-Checksum or Xmodem-1K-CRC.

5. Miscellaneous commands

5.1. Reboot

Used for: Restart the FLEXMod.

Parameters: Opt

Example: Reboot ↵

(Reboot both FPGA and microprocessor)

Notes: -.

5.2. Baud

Used for: Changes the serial port baud rate.

Parameters: BaudRate

Example: Baud 9600 ↵

Baud 115200 ↵

Notes: Boot baud rate will always be 115200bps. Nearly all baud rates can be selected up to 3Mbps.

5.3. GetFWVersion

Used for: Query FLEXMod firmware version.

Parameters: None

Example: GetFWVersion ↵

Notes: Return value is:

BootLoader

vx.xx

5.4. GetSN

Used for: Query FLEXMod serial number.

Parameters: None

Example: GetSN ↵

Notes: Return value is:

SN: xx.xx.xx.xx.xx.xx.xx

5.5. GetTemp

Used for: Display currently FlexMOD temperature.

Parameters: None

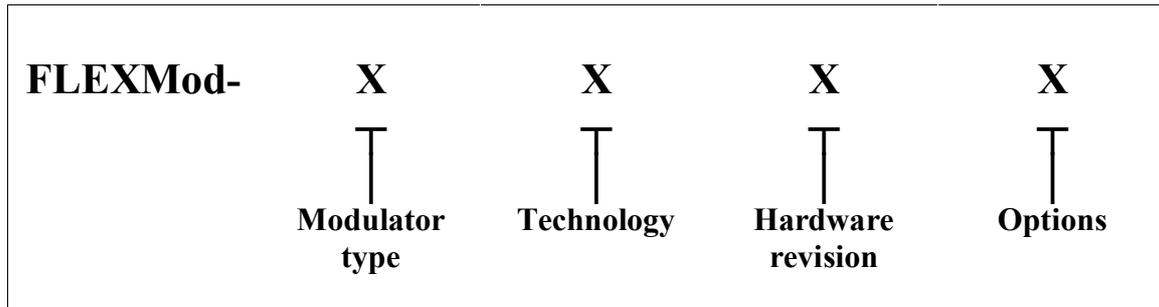
Example: GetTemp ↵

Notes: The temperature is shown in Celsius degree.

6. Alphabetical command list

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Baud.....		H	
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Appendix A FLEXMod Product Identification System



Modulator type	
0	Unprogrammed hardware
1	DVB-T MFN: <i>ETSI EN 300 744</i> compliant COFDM modulator.
2	DVB-S: <i>ETSI EN 300 421</i> compliant QPSK modulator.
3	DVB-C: <i>ETSI EN 300 429</i> compliant QAM modulator.
4	ATSC (A/53) compliant modulator.
5	DVB-S/S2: <i>ETSI EN 300 421/302 307</i> compliant QPSK/8PSK/16,32APSK modulator.
6	DVB-T SFN: <i>ETSI EN 300 744/TS 101 191</i> compliant COFDM modulator.
7	SFN Adapter/MIP Inserter
8	Aspect Ratio corrector and EPG inserter
9	Transport Stream Converter/Remultiplexer
AV1	DVB-T MFN: <i>ETSI EN 300 744</i> compliant COFDM TR391AV Controller
AV2	DVB-S: <i>ETSI EN 300 421</i> compliant QPSK TR391AV Controller
AV3	DVB-C: <i>ETSI EN 300 429</i> compliant QAM TR391AV Controller
CM0	Transport stream Combiner

Technology	
0	Reference clock: 1.024 GHz.
1	Professional tunable reference clock (VCXO): 1.024 GHz.
2	Professional tunable reference clock (VCXO): 1.024 GHz and SFN input FIFO
8	Reference clock: 16 MHz.

Options	
P	Premium type.
N	Unboxed (naked) version.
NP	Unboxed (naked) version, no pins, panelized

Examples:

FLEXMod-101 Consumer grade DVB-T modulator, reference clock 1.024GHz, HW revision 1
FLEXMod-281 Consumer grade DVB-S modulator, reference clock 16MHz, HW revision 1