kontron

» User Guide «

AM4150

U-Boot Bootloader

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1. Introduction to U-Boot

U-Boot is an open source bootloader software developed and maintained by DENX Software Engineering GmbH (http://www.denx.de). Kontron provides U-Boot with all its standard features as well as Kontron-specific features for usage with Kontron's AM4150 AMC module.

This user guide provides specific information on Kontron's implementation of U-Boot and its usage. Please refer to the DENX web site for up-to-date on-line documentation of all of U-Boot's standard features.

2. Standard U-Boot Commands

U-Boot is provided with a set of standard commands for which documentation is available on the DENX web site. Some of the standard commands have sub-groups which can be displayed when help for the main group command is requested. Where relevant, further information concerning the usage of standard commands is provided in this guide to assist users in performing specific functions.

The following table indicates the standard U-boot commands configured for the AM4150. The blue-shaded table cells indicate standard U-Boot commands tested by Kontron. Only the standard U-Boot commands relevant for the normal operation of the AM4150 U-Boot bootloader have been tested by Kontron.

Table 1: Standard U- Boot Commands Configured for the AM4150

COMMAND	DESCRIPTION
?	Alias for 'help'
base	Print or set address offset
bdinfo	Print Board Info structure
boot	Boot default, i.e., run 'bootcmd'
bootd	Boot default, i.e., run 'bootcmd'
bootelf	Boot from an ELF image in memory
bootm	Boot application image from memory
bootp	Boot image via network using BOOTP/TFTP protocol
bootvx	Boot vxWorks from an ELF image
chpart	Change active partition
cmp	Memory compare
coninfo	Print console devices and information
cp	Memory copy
cpu	Multiprocessor CPU boot manipulation and release
crc32	Checksum calculation
dhcp	Boot image via network using DHCP/TFTP protocol
echo	Echo args to console

Table 1: Standard U- Boot Commands Configured for the AM4150 (continued)

COMMAND	DESCRIPTION
editenv	Edit environment variable
env	Environment handling commands
errata	Report errata workarounds
exit	Exit script
ext2load	Load binary file from an Ext2 filesystem
ext2ls	List files in a directory (default /)
false	Do nothing, unsuccessfully
fatinfo	Print information about filesystem
fatload	Load binary file from a dos filesystem
fatls	List files in a directory (default /)
fdt	Flattened device tree utility commands
fsinfo	Print information about filesystems
fsload	Load binary file from a filesystem image
go	Start application at address 'addr'
grepenv	Search environment variables
help	Print command description/usage
i2c	I2C subsystem
iminfo	Print header information for application image
imxtract	Extract a part of a multi-image
interrupts	Enable or disable interrupts
irqinfo	Print information about IRQs
itest	Return true/false on integer compare
loadb	Load binary file over serial line (kermit mode)
loads	Load S-Record file over serial line
loady	Load binary file over serial line (ymodem mode)
loop	Infinite loop on address range
ls	List files in a directory (default /)
md	Memory display
mdio	MDIO utility commands
mii	MII utility commands
mm	Memory modify (auto-incrementing address)
mmc	MMC sub system

Table 1: Standard U- Boot Commands Configured for the AM4150 (continued)

COMMAND	DESCRIPTION
mmcinfo	Display MMC info
mtdparts	Define flash/nand partitions
mtest	Simple RAM read/write test
mw	Memory write (fill)
nand	NAND subsystem
nboot	Boot from NAND device
nfs	Boot image via network using NFS protocol
nm	Memory modify (constant address)
pci	List and access PCI Configuration Space
ping	Send ICMP ECHO_REQUEST to network host
printenv	Print environment variables
reginfo	Print register information
reset	Perform RESET of the CPU
run	Run commands in an environment variable
sata	SATA sub-system
saveenv	Save environment variables to persistent storage
saves	Save S-Record file over serial line
setenv	Set environment variables
setexpr	Set environment variable as the result of eval expression
sf	SPI flash subsystem
showvar	Print local hushshell variables
sleep	Delay execution for some time
source	Run script from memory
test	Minimal test like /bin/sh
tftpboot	Boot image via network using TFTP protocol
true	Do nothing, successfully
ubi	ubi commands
ubifsload	Load file from an UBIFS filesystem
ubifsls	List files in a directory
ubifsmount	Mount UBIFS volume
ubifsumount	Unmount UBIFS volume
version	Print monitor, compiler and linker version

3. Kontron-Specific Commands

Kontron's implementation of U-Boot includes certain enhancements to provide specific functions not incorporated in the standard U-Boot. The following table provides a complete listing of all Kontron-specific U-Boot commands implemented on the AM4150.

Table 2: Kontron-Specific Commands

COMMAND	DESCRIPTION
flsw	FLash SWitch Indicates or selects the currently active SPI boot flash
fru	Field Replaceable Unit Provides read/write access to the board's FRU repository as well as displaying FRU data
fwum	FirmWare Update Manager Provides functions for managing and updating the module's MMC firmware
kboardinfo	Kontron Board Information Displays a summary of board and configuration information
kcs	Access to the Keyboard Controller-Style Interface Sends raw IPMI commands via the KCS interface
md5sum	Message digest 5 checksum Creates or checks the md5 message digest over a memory area
sconf	Kontron Board Configuration Provides functions for software-based configuration of external interfaces available on the AMC Card-edge connector and on the front panel connectors J2 (GbE B)
tlbdbg	Translation Look-aside Buffer DeBuG Displays current configuration of TLB0 and TLB1
vpd	Vital Product Data Provides display and importing functions for vital product data entities

The following chapters provides command syntax reference information, a short description, and, in some cases, usage examples. Where an ellipsis (…) appears in the command syntax, it means that the command is continued on the next line. Observe spaces before the ellipsis.

3.1 flsw Command

flsw

FUNCTION:	Indicates or selects the currently active SPI boot flash
SYNTAX:	**`flsw [s|r]`** where: flsw command: issuing the command without arguments will indicate the currently active SPI boot flash (also returns “true” or “false” depending on the currently active flash) s option: standard selects the standard SPI boot flash as the active flash r option: recovery selects the recovery SPI boot flash as the active flash
DESCRIPTION:	This command is used to determine the currently active SPI boot flash or to select either the standard SPI boot flash or the recovery SPI boot flash as the currently active flash. In addition, this command returns “true” if the standard SPI boot flash is selected or “false” if the recovery SPI boot flash is selected. This is used in the update scripts to prevent the recovery SPI boot flash from being updated. Besides this command, the currently active SPI boot flash may also be selected either via the DIP Switch SW2, switch 2, or the “Set Control State” IPMI OEM command. For further information, refer to the AM4150 User Guide and to the AM4150 IPMI User Guide, respectively. The output of this command always shows the current state.
USAGE:	Query flash status COMMAND / RESPONSE: **`=> flsw`** **`standard boot flash active`** **`=>`**
	Select the standard SPI boot flash as currently active flash COMMAND / RESPONSE: **`=> flsw s`** **`=>`**

3.2 fru Command

fru

FUNCTION:	Provides read/write access to the board's FRU repository as well as displaying FRU data
SYNTAX:	**`fru info <FRU nr>|…`** **`read <FRU nr> <address> <size>|…`** **`write <FRU nr> <address> <size>`** where: fru — command info — option: displays FRU data for <FRU nr> specified <FRU nr> — parameter: hexadecimal <0, 1, … n> identification number of FRU device for option specified read — option: reads FRU data for <FRU nr> specified <address> — parameter: hexadecimal <[x …]x> address where data is to be stored or read from <size> — parameter: hexadecimal <[x …]x> length of data in bytes to be read or written write — option: writes FRU data to <FRU nr> specified
DESCRIPTION:	This command can be used to display basic information about the FRU repository, read out the repository content to RAM, and, if required, to update the contents of the FRU repository. WARNING! Writing incorrect FRU data to the FRU repository can result in an inoperable board (E-Keying information incorrect). Users requiring modification to the board's FRU data are requested to contact Kontron for assistance before making any changes.
USAGE:	Query FRU data for FRU 0 COMMAND / RESPONSE: **`=> fru info 0`** **`FRU 0 size is 0x1000 bytes`** **`=>`**

fru (continued)

USAGE:	Read FRU data for FRU 0 COMMAND / RESPONSE: **=> fru read 0x0 0x1000000 0x1000** **Progress:**## ## ## ## **=>**
	Write FRU data to FRU 0 COMMAND / RESPONSE: **=> fru write 0x0 0x1000000 0x1000** **Progress:**## ## ## ## **=>**

3.3 fwum Command

fwum

FUNCTION:	Provides functions for managing and updating the module's MMC firmware
SYNTAX:	**`fwum info|…`** **`status|…`** **`upgrade <address> <size>|…`** **`rollback`** where: fwum — command info — option: displays information concerning "fwum" services status — option: displays information concerning the status of "fwum" services upgrade — option: updates MMC firmware using parameters as specified by <address> and <size> <address> — parameter: hexadecimal <[x …]x> address in RAM where data is to be read from <size> — parameter: hexadecimal <[x …]x> length of data in bytes to be read rollback — option: executes manual rollback to previous firmware version
DESCRIPTION:	This command can be used to: 1. Info - show information about FWUM service present on IPMI firmware 2. Status - show current status of firmware banks 3. Upgrade - download pointed firmware into MMC and initiate firmware upgrade procedure 4. Rollback - initiate manual firmware rollback to switch back to previously used firmware WARNING! Users requiring modification to the MMC's firmware are requested to contact Kontron for assistance before making any changes.

fwum (continued)

USAGE:

Query firmware service currently available

COMMAND / RESPONSE:

```
=> fwum info

FWUM info (Boot Block)
======================
Protocol Revision          : 07h
Controller Device Id       : 00h
Firmware Revision          : 1.01
Number Of Memory Bank      : 2
=>
```

Query the status of the currently available firmware images

COMMAND / RESPONSE:

```
=> fwum status

FWUM status (IPMI Firmware)
===========================

Bank State 0                : Previous Good
Firmware Length             : 158332 bytes
Firmware Revision           : 2.30 SDR 19 (R13)

Bank State 1                : Last Known Good
Firmware Length             : 160020 bytes
Firmware Revision           : 2.40 SDR 20 (R14)
=>
```

Upgrade MMC firmware:

COMMAND / RESPONSE:

```
=> fwum upgrade 0x20000000 0x22ef0
Start uploading firmware into bank 0
Loading: ##############################################
         ##############################################
         ##############################################
         ##############################################
         ##############################################
         ##############################################
         ######################################
Firmware update initiated
=>
```

Perform manual rollback of MMC firmware

COMMAND / RESPONSE:

```
=> fwum rollback
Firmware rollback initiated
=>
```

3.4 kboardinfo Command

kboardinfo

FUNCTION:	Displays a summary of board and configuration information
SYNTAX:	**kboardinfo** where: kboardinfo command
DESCRIPTION:	This command collects information from various board sources and provides a summary listing of this information:
USAGE:	Display board information COMMAND / RESPONSE: **=> kboardinfo** **Board id: 0xd0c0** **Hardware rev.: 0xf** **Logic rev.: 0x4** **Boot flash: Standard Flash** **In system slot: na** **Geographic address: 1** **Material number: na** **Serial number: 0400168722** **U-Boot article name: SK-FIRM-UBOOT-D0C01** **U-Boot material num: 1052-4330** **=>**

3.5 kcs Command

kcs

FUNCTION:	Provides capability for transmitting raw IPMI commands from the payload CPU to the MMC and displaying response from the MMC
SYNTAX:	**`kcs raw [lun <lun>] <NetFn> <CMD> [Request Data Bytes]|…`** **`mcinfo`** where: kcs — command raw — option: send raw data over KCS interface lun — option: if present: set up desired lun number of message to send to MMC; if absent: lun is assumed to be 0 <lun> — parameter: hexadecimal; parameter range: <0, 1, 2, 3> <NetFn> — parameter: hexadecimal <[x …]x> <CMD> — parameter: hexadecimal Request Data Bytes — parameter: hexadecimal: 1 ... n bytes (space as delimiter between bytes) command parameters mcinfo — option: show result of the “Get Device ID” IPMI OEM command in human-readable format
DESCRIPTION:	This command can be used to send IPMI commands in raw form to the MMC over the KCS interface and print response. WARNING! As “ipmi raw” functions provide access to the majority of MMC functionality, care must be exercised when invoking raw commands. Improper use may cause the board to become inoperable (e.g. damage to FRU data).

kcs (continued)

USAGE:

Send IPMI “Get Device ID” command (lun 0, NetFn 6, cmd 1, no data) using the “kcs raw” option

COMMAND / RESPONSE:

```
=> kcs raw lun 0x00 0x06 0x01
KCS transaction successfully completed, rsp_size: 18
(dec)
 1c 01 00 10 80 01 00 51 b9 98 3a 00 00 d0 10…
 05 00 00
=>
```

Response bytes:
- first byte presents return NetFn combined with lun
- second presents command number
- third presents completion code
- further bytes are response data

In this example, the first byte (0x1c) is decoded as lun 0 (two least significant bits) and NetFn 7 (six most significant bits).

Send IPMI “Get FRU Inventory Area” command to get information about FRU 0 repository (lun 0, NetFn 16, cmd 10, data byte 0x00)

COMMAND / RESPONSE:

```
=> kcs raw 0x0a 0x10 0x00
KCS transaction successfully completed,… rsp_size: 6
(dec)
2c 10 00 00 10 00
=>
```

kcs (continued)

USAGE: Send IPMI “Get Device ID” command using the “kcs mcinfo” option

COMMAND / RESPONSE:

```
=> kcs mcinfo
Device ID                 : 16
Device Revision           : 0
Firmware Revision         : 2.49
IPMI Version              : 1.5
Manufacturer ID           : 15000
Manufacturer Name         : Kontron
Product ID                : 53248 (0xd000)
Device Available          : yes
Provides Device SDRs      : yes
Additional Device Support :
    Chassis Device
    IPMB Event Generator
    IPMB Event Receiver
    FRU Inventory Device
    Sensor Device
Aux Firmware Revision Info:
    0x00 - SAP Revision
    0x01
    0x49
    0x00
=>
```

3.6 md5sum Command

md5sum

FUNCTION:	Creates or checks the md5 message digest over a memory area
SYNTAX:	**`md5sum <data-address> <length> [<cksum-address>]`** where: md5sum command <data-address> parameter: hexadecimal start address of memory area <length> parameter: hexadecimal length of memory area <cksum-address> parameter: if present: compares the calculated md5 message digest with the md5 message digest available at this address if absent: calculates the md5 message digest over the specified memory range and prints it to the console
DESCRIPTION:	This command is used to create or check the md5 message digest over a memory area. If the optional 3rd parameter <checksum-address> is omitted, the md5 message digest is calculated over the specified memory range and printed to the console. If the optional 3rd parameter <checksum-address> is specified, the md5 message digest is calculated over the specified memory range and compared with the md5 message digest at <cksum-address>. If the digest is identical, the command returns 0; if the digests do not match, a value other than zero is returned. When a comparison is made, nothing is printed to the console since this usage of the command is meant to be used within scripts. The md5 message digest at <cksum-address> may be specified in ASCII or binary format.
USAGE:	Calculate an md5 message digest COMMAND / RESPONSE: **`=> md5sum 100000 80000`** **`8fe7006660a2df2265b7cd707eb98786`** **`=>`**

md5sum (continued)

USAGE:	Check the md5 message digest of a file previously loaded to 100000 with a size of 80000 and its md5 message digest loaded to 10000 in a script COMMAND / RESPONSE: **=> setenv check_crc “if md5sum 100000 80000 10000; then echo ‘md5 message digest OK’; else echo ‘md5 message digest BAD’; fi”** **=>run check_crc** **md5 message digest OK** **=>**

3.7 sconf Command

sconf

FUNCTION:	Provides functions for software-based configuration of external interfaces available on the AMC Card-edge connector and on the front panel connectors J2 (GbE B)
SYNTAX:	**`sconf info|…`** **`select <num>|…`** **`set [<par> <val>]|…`** **`status|…`** **`save [reset]|…`** **`undo|…`**

where:

sconf	command
info	option: displays available configurations
select	option: selects base configuration <num>
<num>	parameter: <0, 1, ... n> number of base configuration
set	option: indicate or configure parameter for new base configuration
[<par>]	parameter: <…> parameter for new base configuration
[<val>]	value: <…> value assigned to parameter
status	option: displays information concerning the status of board configuration
save	option: saves the current setting
[reset]	option: resets the board after saving the settings
undo	option: ignore current settings and use saved settings again

sconf (continued)

DESCRIPTION:	This command is used to configure external interfaces available on the AMC Card-edge connector and on the front panel connectors J2 (GbE B). The “sconf info” command shows the possible configurations as well as the configuration stored in the IPMI Module Management Controller. The active configuration is indicated in the “sconf status” command. To configure external interfaces, select a base configuration via the “sconf select” command. Then, the parameters can be defined more exactly via the “sconf set” command. To apply the configuration, invoke the “sconf save reset” command (“sconf save” command with “reset” option). Only with this command the configuration will become valid and active. To determine if a system power cycle is required, invoke the “sconf status” command.

sconf (continued)

USAGE: Display available configurations

COMMAND / RESPONSE:

```
=> sconf info

List of available base configurations:
**<  >** Stored base configuration
--[  ]-- 'New'base configuration (work in progress)
========+=============================================================
  Base  | Port 0  Port 1  Port 2  Port 3       Port 4           Port 8
 Config |                                        ..7             ..11
========+=============================================================
        |
**[ 0]**|   GbE   [GbE]    SATA     --    SRIO [@5.0]     SRIO  [@5.0]
        |
  < 1>  |   GbE   [GbE]    SATA     --    SRIO @3.125     SRIO  @3.125
        |
  < 2>  |   GbE   [GbE]    SATA     --    SRIO [@5.0]      GbE   [2x1]
        |
  < 3>  |   GbE   [GbE]    SATA     --    PCIE[Gen.2]     PCIE [Gen.2]
        |
  < 4>  |   GbE   [GbE]    SATA     --    PCIE[Gen.2]      GbE   [2x1]
        |
  < 5>  |   GbE   [GbE]    SATA     --    PCIE[Gen.2]  PCIE, GbE, [-], -
        |

Note: [GbE] indicates that the DTSEC4 used can be redirected to the
front panel connector J2 (GbE B) or optionally to AMC Port 10 for
configurations which provide GbE interfaces in the Fat Pipes Region,
Port 8 or Port 9.

Board's Port Configuration:

Option / Setting | Value #  command,  option  <and parameter>
-----------------------------------------------------------
DTSEC4  routing : port1 # sconf set  dtsec4  <port1 | front>
SRIO   Sys.Size : large # sconf set    srio  <small | large>
SRIO       mode : agent # sconf set    srio  <agent | host >

AMC Port Activation / Forced settings (ignoring E-Keying):

Option / Setting | Value #  command,  option  <and parameter>
-------------------------------------------------------------
Port 2          : auto  # sconf set  port 2  <auto | disable | enable>
Port 4          : auto  # sconf set  port 4  <auto | disable | enable>
         speed : @5.0  # sconf set  port 4  <@5.0 | @2.5>
Port 8          : auto  # sconf set  port 8  <auto | disable | enable>
         speed : @5.0  # sconf set  port 8  <@5.0 | @2.5>

Note: A port's speed configuration becomes effective if the port is
enabled when running the module in unmanaged mode or the port is
forcibly enabled (i.e. not set to 'auto') in managed mode.
=>
```

sconf (continued)

USAGE:

Select new base configuration

COMMAND / RESPONSE:

```
=> sconf select 1
New base configuration 1
=>
```

Configure parameter for new base configuration

COMMAND / RESPONSE:

```
=> sconf set

Board's Port Configuration:

Option / Setting | Value #  command,  option  <and parameter>
-----------------------------------------------------------
DTSEC4  routing : port1 # sconf set  dtsec4  <port1 | front>
SRIO   Sys.Size : large # sconf set    srio  <small | large>
SRIO       mode : agent # sconf set    srio  <agent | host >

AMC Port Activation / Forced settings (ignoring E-Keying):

Option / Setting | Value #  command,  option  <and parameter>
-----------------------------------------------------------
Port 2           : auto  # sconf set  port 2  <auto | disable | enable>
Port 4           : auto  # sconf set  port 4  <auto | disable | enable>
          speed  : @5.0  # sconf set  port 4  <@5.0 | @2.5>
Port 8           : auto  # sconf set  port 8  <auto | disable | enable>
          speed  : @5.0  # sconf set  port 8  <@5.0 | @2.5>

Note: A port's speed configuration becomes effective if the port is
enabled when running the module in unmanaged mode, or the port is
forcibly enabled (i.e. not set to 'auto') in managed mode.


=> sconf set port4 disable
=>
```

Display current "sconf" status

COMMAND / RESPONSE:

```
=> sconf status

Configuration (Activation) Status:
   Module is running:                  managed (E-Keying)
   sconf disables E-Keying:            no
   sconf deactivated by DIP SW:        no

   Configuration (stored) is active:
      AMC Base Configuration:          0
=>
```

sconf (continued)

	Save current settings
	COMMAND / RESPONSE:
	`=> sconf save`
	`Saving: #####`
	`=>`

USAGE:	Save current settings and reset the board
	COMMAND / RESPONSE:
	`=> sconf save reset`
	`Saving: #######`
	
	`U-Boot 2011.09-01425-g8c4588b (Jun 20 2012 - 10:36:29)`
	
	`CPU0: P5020E, Version: 1.0, (0x82280010)`
	`Core: E5500, Version: 1.0, (0x80240010`
	`...`
	`=>`

	Ignore current settings and use saved settings again
	COMMAND / RESPONSE:
	`=>sconf undo`
	`=>`

3.8 tlbdbg Command

tlbdbg

FUNCTION:	Displays current configuration of TLB0 and TLB1
SYNTAX:	**tlbdbg** where: tlbdbg command
DESCRIPTION:	This command provides information on the translation look-aside buffers TLB0 ad TLB1 for debugging purposes during U-Boot development or for debugging OS startup issues.
USAGE:	Display TLB0/TLB1 information COMMAND / RESPONSE:

```
=> tlbdbg
TLBx Configuration Register : 04110200 401bc040


TLB0: [check 512 entries]
IDX  PID EPN       SIZE  V TS    RPN       U0-U3 WIMGE UUUSSS
------------------------------------------------------------

TLB1: [check 64 entries]
IDX  PID EPN       SIZE  V TS    RPN       U0-U3 WIMGE UUUSSS
------------------------------------------------------------
  1d: 00  fe000000  16MB  V 0d  -> f_fe000000 0000 -I-G- ---RWX
  2d: 00  00000000  1GB   V 0d  -> 0_00000000 0000 ----- ---RWX
  3d: 00  80000000  1GB   V 0d  -> e_80000000 0000 -I-G- ---RWX
  4d: 00  40000000  1GB   V 0d  -> 0_40000000 0000 ----- ---RWX
  5d: 00  ffc00000  64kB  V 0d  -> e_ffc00000 0000 -I-G- ---RWX
  6d: 00  ffc10000  64kB  V 0d  -> e_ffc10000 0000 -I-G- ---RWX
  7d: 00  ff000000  4kB   V 0d  -> f_ff000000 0000 -I-G- ---RWX
  9d: 00  f4000000  1MB   V 0d  -> f_f4000000 0000 ----- ---RWX
 10d: 00  f4100000  1MB   V 0d  -> f_f4100000 0000 -I-G- ---RWX
 11d: 00  f4200000  1MB   V 0d  -> f_f4200000 0000 ----- ---RWX
 12d: 00  f4300000  1MB   V 0d  -> f_f4300000 0000 -I-G- ---RWX
 13d: 00  f0000000  4MB   V 0d  -> f_00000000 0000 -I-G- ---RWX
 16d: 00  f8080000  64kB  V 0d  -> f_f8080000 0000 -I-G- ---RWX
 17d: 00  fffff000  4kB   V 0d  -> 0_7ffff000 0000 -I-G- ---RWX
 18d: 00  f8090000  64kB  V 0d  -> f_f8090000 0000 -I-G- ---RWX
 19d: 00  c0000000  256MB V 0d  -> d_c0000000 0000 -I-G- ---RWX
 20d: 00  d0000000  256MB V 0d  -> d_d0000000 0000 -I-G- ---RWX
=>
```

3.9 vpd Command

vpd

FUNCTION:	Provides display and importing functions for vital product data entities
SYNTAX:	**`vpd print [<name>]|…`** **`import <name>|all_params`** where: vpd — command print — option: displays VPD information (source: System EEPROM) (if <name> is not used, all VPD entities are displayed) <name> — parameter: text string <[x …]x> name of VPD entity addressed by option import — option: imports VPD information to the U-Boot environment (source: System EEPROM; target: RAM) all_params — parameter: text constant all_params selects all VPD entities for importing to the U-Boot environment
DESCRIPTION:	Vital Product Data are information stored in the System EEPROM which are required for proper operation of the board. With this command the VPD entities can be displayed or imported to the U-Boot environment in RAM. Among the VPD entities are, for example, the board serial number and the board's Ethernet MAC addresses. If the option "import" is invoked, existing VPD entities in the environment in RAM are overwritten. If a "saveenv" is then invoked, the previously stored values in the currently active SPI boot flash environment area are overwritten.
USAGE:	Display all VPD entities COMMAND / RESPONSE: **`=> vpd print`** ***`<response: displays all VPD entities>`*** **`=>`**

vpd (continued)

USAGE:	Display eth1addr entity
	COMMAND / RESPONSE:
	`=> vpd print eth1addr`
	`eth1addr=00:80:82:47:12:02`
	`=>`

	Import eth1addr entity to environment
	COMMAND / RESPONSE:
	`=> vpd import eth1addr`
	`import eth1addr = 00:80:82:47:12:02 to … environment`
	`=>`

	Import all VPD entities to environment
	COMMAND / RESPONSE:
	`=> vpd import all_params`
	`<response: displays all imported VPD entities; format for each imported VPD entity as follows:>`
	`import <name> = <value> to environment`
	`.`
	`.`
	`.`
	`import <name> = <value> to environment`
	`=>`

4. U-Boot Access and Startup

Communication with U-Boot is achieved via a serial console configured for 115200 baud, 8N1, no hardware handshake.

Initially, U-Boot executes the commands defined in the environment variable “preboot”. Then, if not otherwise interrupted, U-Boot pauses for the time defined in the environment variable “bootdelay” and then executes the statements stored in the environment variable “bootcmd”. To gain access to the U-Boot command prompt, type in any single character during the boot delay time.

If required, the boot delay function can be configured in such a way that even when the boot delay is set to “0” to have characters, which are sent over the serial interface prior to the boot wait time, be recognized to allow operator intervention in the boot process.

5. Environment

The environment is stored in the same flash as U-Boot, usually in the last sector. This provides the possibility to update U-Boot without changing the environment. The environment can be modified by the user with the typical commands of the “env” command group: “setenv”, “editenv”, “printenv” and “saveenv”.

Furthermore, if a larger number of boards require updating, the environment can be updated by a script, loaded from the SD card, onboard NAND flash, or a network.

A typical user modification would be to set the variable “bootcmd” so that the user’s OS will boot automatically.

6. Working with U-Boot

6.1 General Operation

Most operations are carried out using the main memory as an intermediate step. It is not possible, for example, to boot a kernel image directly from a tftp server. Instead, the kernel image is first loaded to memory and then booted from there with another command.

The same is true when writing new contents to the SPI boot flashes.

This concept is very flexible since it separates the commands which handle the loading of data from the commands that carry out actions like booting.

6.2 Using the sconf Command

In previous board designs, DIP switches were used to configure the fabric interfaces. In response to evolving application requirements, the “sconf” command has been designed to provide increased configuration flexibility.

The AM4150 is delivered with a default configuration for the external interfaces routed to the AMC ports. If required, these interfaces may be configured via the “sconf” command according to the application requirements.

The factory default configuration for the AM4150 is as follows:

- “sconf” base configuration: 0
- SRIO system size: small
- SRIO interface mode: agent
- GbE (DTSEC4): port 1

To obtain information about the currently active configuration, invoke the “sconf status” command.

6.2.1 Overview of Board Configuration Options

Table 3: Overview of Board Configuration Options

AMC PORT CONFIGURATION USING THE U-BOOT "sconf info" BASE CONFIGURATIONS							FURTHER BOARD CONFIGURATION OPTIONS DEPENDING ON THE BASE CONFIGURATION					
"sconf" Base Conf.	AMC PORT						GbE DTSEC4	SRIO Sys. Size	SRIO Mode	FCLKA PCIe Ref. Clock	Ports 4 - 7 Speed Options	Ports 8 - 11 Speed Options
	0	1	2	3	4 - 7	8 - 11						
0	GbE	[GbE]	SATA	SATA/ --	SRIO [@5.0]	SRIO [@5.0]	port 1/ front	small/ large	host/ agent	--	@5.0/ @2.5	@5.0/ @2.5
1	GbE	[GbE]	SATA	SATA/ --	SRIO @3.125	SRIO@ 3.125	port 1/ front	small/ large	host/ agent	--	--	--
2	GbE	[GbE]	SATA	SATA/ --	SRIO [@5.0]	GbE, GbE, [GbE], --	port 1/ port 10/ front	small/ large	host/ agent	--	@5.0/ @3.125/ @2.5	--
3	GbE	[GbE]	SATA	SATA/ --	PCIE [Gen.2]	PCIE [Gen.2]	port 1/ front	--	--	auto/in/ out/local	@5.0/ @2.5	@5.0/ @2.5
4	GbE	[GbE]	SATA	SATA/ --	PCIE [Gen.2]	GbE, GbE, [GbE], --	port 1/ port 10/ front	--	--	auto/in/ out/local	@5.0/ @2.5	--
5	GbE	[GbE]	SATA	SATA/ --	PCIE [Gen.2]	PCIE, GbE, [GbE], --	port 1/ port 10/ front	--	--	auto/in/ out/local	@5.0/ @2.5	--

Note ...

[GbE] indicates that DTSEC4 used can be redirected to the front panel connector J2 (GbE B) or optionally to AMC Port 10 for configurations which provide GbE interfaces in the Fat Pipes Region, Port 8 or Port 9.

Note ...

There are two SATA ports available on the AM4150. The first SATA port is routed to the AMC port 2. The second SATA port is routed either to AMC port 3 or to the SATA Flash module.

The parameters of the FCLKA option have the following properties:

- auto: The Module Management Controller configures the PCI Express reference clock (FCLKA) via E-Keying
- in: AM4150 uses the PCI Express reference clock from the AMC Card-edge connector (FCLKA)
- out: AM4150 uses the local PCI Express reference clock and generates the PCI Express reference clock to the AMC Card-edge connector (FCLKA)
- local: AM4150 uses the local PCI Express reference clock and the AMC clock (FCLKA) is disabled

6.2.2 Example of sconf Command Usage

6.2.2.1 sconf info

To get an overview of the possible interface configurations, invoke the “sconf info” command.

```
=> sconf info

List of available base configurations:
**<  >** Stored base configuration
--[  ]-- ‘New’base configuration (work in progress)
========+=============================================================
  Base  | Port 0   Port 1 Port 2  Port 3          Port 4          Port 8
 Config |                                            ..7           ..11
========+=============================================================
        |
**[ 0]**|    GbE   [GbE]   SATA      --    SRIO  [@5.0]      SRIO[@5.0]
        |
  < 1>  |    GbE   [GbE]   SATA      --    SRIO  @3.125      SRIO@3.125
        |
  < 2>  |    GbE   [GbE]   SATA      --    SRIO  [@5.0]       GbE [2x1]
        |
  < 3>  |    GbE   [GbE]   SATA      --    PCIE [Gen.2]      PCIE[Gen.2]
        |
  < 4>  |    GbE   [GbE]   SATA      --    PCIE [Gen.2]       GbE [2x1]
        |
  < 5>  |    GbE   [GbE]   SATA      --    PCIE [Gen.2]  PCIE,GbE,[-],-
        |

Note: [GbE] indicates that the DTSEC4 used can be redirected to the
front panel connector J2 (GbE B) or optionally to AMC Port 10 for
configurations which provide GbE interfaces in the Fat Pipes Region,
Port 8 or Port 9.

Board’s Port Configuration:

Option / Setting | Value #   command,   option  <and parameter>
-------------------------------------------------------------
DTSEC4  routing : port1 #  sconf set   dtsec4  <port1 | front>
SRIO   Sys.Size : large #  sconf set     srio  <small | large>
SRIO       mode : agent #  sconf set     srio  <agent | host >

AMC Port Activation / Forced settings (ignoring E-Keying):

Option / Setting | Value #   command,   option  <and parameter>
-------------------------------------------------------------
Port 2          : auto  #  sconf set   port 2  <auto | disable | enable>
Port 4          : auto  #  sconf set   port 4  <auto | disable | enable>
          speed : @5.0  #  sconf set   port 4  <@5.0 | @2.5>
Port 8          : auto  #  sconf set   port 8  <auto | disable | enable>
          speed : @5.0  #  sconf set   port 8  <@5.0 | @2.5>

Note: A port’s speed configuration becomes effective if the port is
enabled when running the module in unmanaged mode or the port is
forcibly enabled (i.e. not set to ‘auto’) in managed mode.
=>
```

6.2.2.2 sconf select

To change the setting, invoke the “sconf select” command.

Example:

```
=> sconf select 2
New base configuration 2
=>
```

6.2.2.3 sconf set

The setting of the chosen base configuration can be changed via the “sconf set” command. If the “sconf set” command is invoked without parameters, all changeable options are shown. In the following example, first, all possible settings are shown, and then the Ethernet interface FM1@DTSEC4 is changed from the AMC port 1 to the front Ethernet connector J2 (GbE B).

```
=> sconf set

Board’s Port Configuration:

Option / Setting | Value #   command,   option  <and parameter>
-------------------------------------------------------------
DTSEC4  routing : port1 #  sconf set   dtsec4  <port1 | front>
SRIO   Sys.Size : large #  sconf set     srio  <small | large>
SRIO       mode : agent #  sconf set     srio  <agent | host >

AMC Port Activation / Forced settings (ignoring E-Keying):

Option / Setting | Value #   command,   option  <and parameter>
-------------------------------------------------------------
Port 2          : auto  #  sconf set   port 2  <auto | disable | enable>
Port 4          : auto  #  sconf set   port 4  <auto | disable | enable>
          speed : @5.0  #  sconf set   port 4  <@5.0 | @2.5>
Port 8          : auto  #  sconf set   port 8  <auto | disable | enable>
          speed : @5.0  #  sconf set   port 8  <@5.0 | @2.5>
Note: A port’s speed configuration becomes effective if the port is
enabled when running the module in unmanaged mode or the port is
forcibly enabled (i.e. not set to ‘auto’) in managed mode.

=> sconf set dtsec4 front
=>
```

6.2.2.4 sconf save reset

Finally, the configuration must be saved with “sconf save”. The “sconf save” command stores the settings but does not activate them. To activate the settings, use the “sconf save reset” command.

```
=> sconf save reset
Saving: #######

U-Boot ...
...
=>
```

6.2.2.5 sconf status

To determine if a system power cycle is required, invoke the “sconf status” command. The following example shows that a system power cycle is required.

```
=> sconf status

Configuration (Activation) Status:
   Module is running:                    managed (E-Keying)
   sconf disables E-Keying:              no
   sconf deactivated by DIP-SW:          no

   Configuration is not active:
      Save operation required:           no
      Power On Reset required:           no
      System Power Cycle required:       yes
      Active AMC Base Configuration:     n.a.
      Stored AMC Base Configuration:     2
      ‘New’ AMC Base Configuration:      2
=>
```

The following is an example of the output shown after a successfully completed system power cycle.

```
=> sconf status

Configuration (Activation) Status:
   Module is running:                    managed (E-Keying)
   sconf disables E-Keying:              no
   sconf deactivated by DIP-SW:          no

   Configuration (stored) is active:
      Stored AMC Base Configuration:     2
=>
```

6.3 Using the Network

6.3.1 Interface Selection

U-Boot provides support for multiple Ethernet interfaces for transferring files from a file server. This is accomplished using the environment variables: “ethprime”, “ethact” and “ethrotate”.

The following table indicates the assignment of the Ethernet interfaces to the AMC ports or to the GbE front panel connectors depending on the active “sconf” base configuration.

Table 4: Ethernet Interface Assignment Depending on the Base Configuration

BASE CONFIGURATION	ETHERNET INTERFACE	AMC PORT/CONNECTOR
0, 1, 3	FM1@DTSEC3	Front panel connector J3 (GbE A)
	FM1@DTSEC4	Either AMC port 1 or front panel connector J2 (GbE B), depending on the setting of “sconf set dsec4 [port1/front]”
	FM1@DTSEC5	AMC port 0
2, 4	FM1@DTSEC1	AMC port 8
	FM1@DTSEC2	AMC port 9
	FM1@DTSEC3	Front panel connector J3 (GbE A)
	FM1@DTSEC4	Either AMC port 1, AMC port 10 or front panel connector J2 (GbE B), depending on the setting of “sconf set dsec4 [port1/port10/front]”
	FM1@DTSEC5	AMC port 0
5	FM1@DTSEC2	AMC port 9
	FM1@DTSEC3	Front panel connector J3 (GbE A)
	FM1@DTSEC4	Either AMC port 1, AMC port 10 or front panel connector J2 (GbE B), depending on the setting of “sconf set dsec4 [port1/port10/front]”
	FM1@DTSEC5	AMC port 0

6.3.1.1 ethprime

“ethprime” is used to select the required interface after power-up or reset. During boot-up, the U-Boot checks if “ethprime” is set. If set, “ethprime” is used as the first active Ethernet interface (“ethact”). Please note that the setting of the “ethprime” is lost after a reset. To retain the environment permanently, use the command “saveenv”, which saves the complete environment to flash.

Example:

```
=> setenv ethprime FM1@DTSEC3
=> saveenv
Saving environment to SPI Flash...
2 MiB
SF: Detected AT25DF161 with page size 256 Bytes, total 2 MiB
Erasing SPI flash...Writing to SPI flash...done
=> reset
...
=> printenv ethact
ethact=FM1@DTSEC3
=>
```

6.3.1.2 ethact

“ethact” is used to define the currently active interface and to change the required interface without rebooting. If a reboot or a power cycle is done, the active Ethernet interface will be set back to the interface defined in “ethprime” or selected by the “ethrotate” functionality.

Example:

```
=> setenv ethact FM1@DTSEC2
=> ping 172.100.100.35
Using FM1DTSEC2 device
host 172.100.100.35 is alive
=>
```

6.3.1.3 ethrotate

“ethrotate” can be used to force the selection of the next available interface if, for example, there is no link available for the selected interface.

If set to “yes” or undefined, U-Boot updates the “ethact” variable accordingly and tries to download the file again. This is repeated until either the file is downloaded or all interfaces have been exhausted.

In the event the link is active for the selected interface and “ethrotate” is “yes” or undefined, U-Boot tries to download the file. If it cannot download the file, it tries the next available interface. If the file is not available on the server, U-Boot stops trying and issues an error message.

If “ethrotate” is set to “no”, only the interface defined in “ethact” is used.

Please note that the setting of the “ethrotate” is lost after a reset. To retain the environment permanently, use the command “saveenv”, which saves the complete environment to flash.

6.3.2 Contacting the Server

In addition, to be able to transfer files from a tftp server to a module, the module's IP address (environment variable "ipaddr") and the IP address of the server must be set (environment variable "serverip"). Alternatively, it is possible to use the "dhcp" or "bootp" commands.

They can be set using the "setenv" command. Please note that these settings are lost after a reset. To retain the environment permanently, use the command "saveenv", which saves the complete environment to flash.

To transfer a file from a tftp server to memory, the "tftpboot" command is used, for example:

```
tftpboot 100000 filename
```

6.4 Using SD Cards

SD cards are supported (read only) with the "ext2" or "fat" file system.

In both cases, the card must be rescanned first.

```
mmc rescan 0
```

After that, the contents can be verified with:

```
ext2ls mmc 0
```

in case of the ext2 file system, or with

```
fatls mmc 0
```

in case of the fat file system.

To load a file into memory, the commands "ext2load" or "fatload" can be used, for example:

```
ext2load mmc 0 100000 kernel.bin
```

which loads the file "kernel.bin" from the SD card to memory address 0x100000.

6.5 Using SATA Devices

SATA devices are supported (read only) with the “ext2” or “fat” file system.

In both cases, the SATA devices must be initialized first.

```
sata init
```

After that, the contents can be verified with:

```
ext2ls sata 0
```

in case of the ext2 file system, or with

```
fatls sata 0
```

in case of the fat file system.

To load a file into memory, the commands “ext2load” or “fatload” can be used, for example:

```
ext2load sata 0 1000000 kernel.bin
```

which loads the file “kernel.bin” from the SATA device to memory address 0x1000000.

6.6 Using the Onboard NAND Flash

The onboard NAND Flash is supported with the “ubi” filesystem. The access is read only. Thus, the filesystem and its contents must be prepared with Linux first.

As a prerequisite, the environment variables “mtdids” and “mtdparts” must be set correctly.

“mtdids” identifies the NAND chip to use while “mtdparts” defines the partitions.

Example:

```
setenv mtdids nand0=chip1
setenv mtdparts mtdparts=chip1:-(all)
```

This defines the first NAND chip (nand0) to be used with the name “chip1”. The chip contains one partition “all” which occupies the whole chip.

The next command sets the partition “all” to be used with the “ubi” layer:

```
ubi part all
```

Now, an “ubi” volume can be mounted; in this example volume “boot”:

```
ubifsmount boot
```

After the volume is mounted, its contents can be listed:

```
ubifsls
```

or a file loaded, in this case “kernel.bin” to address 0x100000:

```
ubifsload 100000 kernel.bin
```

6.7 Using the SPI Flash for OS

The SPI flash for OS is not used together with a file system, it is used raw. It does not contain any U-Boot components and is completely free for user usage. It's primary function is to store VxWorks® boot ROMs and images.

Before making any changes to the flashes, ensure that the correct flash is selected. To select the SPI flash for OS, execute the “sf probe 3” command (SPI flash for OS is routed to the processor’s SPI controller chip select 3).

The SPI flash must be erased before it is programmed. To achieve this, use the “sf erase” command.

To program an image to the SPI flash, it must first be loaded to memory from an arbitrary source. It can then be programmed with the “sf write” command.

Example: Programming a test file “test.img” from an SD card using the “ext2” file system:

```
mmc rescan 0
ext2load mmc 0 100000 test.img
sf probe 3
sf erase 0 10000
sf write 100000 0 ${filesize}
```

This example assumes that the size of “test.img” is less than 64 kB. The environment variable “filesize” is set automatically when a file is loaded to memory and can be used for convenience here.

6.8 Booting an OS

6.8.1 Booting Linux

To boot Linux, at least a kernel image and a FDT (Flattened Device Tree) must be loaded to memory. Optionally, an “initrd” can be loaded.

Furthermore, a command line must be prepared in the environment variable “bootargs”.

The boot itself is initiated with the “bootm” command.

To simplify the setup of the board, three predefined scripts are already programmed in the default environment:

- “nfsboot” to boot from a tftp server and mount the root over NFS
- “nandboot” to boot from the NAND flash and also mount it as root
- “sdboot” to boot from a SD Card and also mount it as root
- “multi_img_boot” to boot from the multi-image provided. The multi-image consists of a FDT, a kernel and a rootfs

For a one-time-only bootup, this can be accomplished with the “run” command, for example:

```
run nfsboot
```

To make this permanent and have the board execute it automatically, it must be stored in the “bootcmd” environment variable and the environment must be saved to flash.

Example:

```
setenv bootcmd 'run nandboot'
saveenv
```

6.8.2 Booting VxWorks

To boot a Wind River VxWorks image, a boot image file of the corresponding (ROM-able) VxWorks binary image and an FDT (Flattened Device Tree) must be loaded to memory.

By default U-Boot operates on “uImage” files (boot image for U-Boot) which contain a special header and in the data portion the operating system binary image. The special header defines various properties of the “uImage” file (e.g. load address and entry point for the binary image in the data portion). Both the header and the data portion of the “uImage” file are secured and checked against corruption by a CRC32 checksum at U-Boot load time.

All VxWorks (ROM-able) binary images will be converted to a “uImage” file at build time of the suited Wind River Workbench projects based on the dedicated Kontron VxWorks BSP (Board Support Package). This conversion will be carried out by the “mkImage” Kontron tool, which is automatically invoked by Wind River Workbench.

On successful build of the VxWorks binary (ROM-able) image, an additional “uImage” file containing the VxWorks (ROM-able) binary image will be generated in the project default build folder with the following naming conventions:

U-BOOT “uImage” NAME	VXWORKS IMAGE NAME
uImage.bootrom.bin	bootrom.bin
uImage.vxWorks_rom.bin	vxWorks_rom.bin
uImage.vxWorks_romCompress.bin	vxWorks_romCompress.bin

Please note that the resulting “uImage” file contains all needed information for a proper U-Boot load process and start of the contained VxWorks binary (ROM-able) image. Therefore, it is strongly recommended to utilize the corresponding “uImage” file listed above when using U-Boot for booting VxWorks.

The “uImage” file and FDT are typically stored in and loaded from the SPI flash for OS.

The boot itself is initiated with the “bootm” command. To perform autobooting of a VxWorks image requires that appropriate U-Boot environment variables or script(s) be defined for the boot operation to be performed. For more detailed information with examples of boot command sequences, refer to the Kontron VxWorks BSP online documentation.

For more information on how to configure and build VxWorks images and how to utilize them e.g. for a subsequent VxWorks boot process, please refer to the appropriate Wind River documentation.

6.9 Getting Help

U-Boot was configured with support for longhelp. This means that online help is available for every command while working with the system. To access the online help, enter “?” or “help” at the console prompt. This will show an overview over all available commands. To get specific help, enter “? <command/command group” or “help <command/command group”.

For example to get help on the “saves” command enter “? saves”.

```
=> ? saves
saves - save S-Record file over serial line
Usage:
saves [ off ] [size] [ baud ]
    - save S-Record file over serial line with offset 'off', size
'size' and
      baudrate 'baud'
=>
```

To get help on the mmc command group enter “? mmc”.

```
=> ? mmc
mmc - MMC sub system
Usage:
mmc read <device num> addr blk# cnt
mmc write <device num> addr blk# cnt
mmc rescan <device num>
mmc part <device num> - lists available partition on mmc
mmc list - lists available devices
=>
```

6.10 Update

The environment contains two scripts which allow an update of various components, e.g. U-Boot, bootrom for VxWorks, data in EEPROMs, etc.

The script “update” checks for a U-Boot script “update” in the directory “update” in the first partition of the SD card with “ext2” or “fat” filesystem. If unsuccessful, the check continues with the first NAND chip, volume “boot”, and again U-Boot searches in the subdirectory “update” for the script “update”. If the script “update” is found, it is loaded to memory and executed.

So, to actually execute an update, e.g. an SD card should be prepared with a directory “update” on the first partition. Kontron provides an update e.g. for U-Boot as a compressed archive (zip, tar.bz2, tar.gz) which must be unpacked in the directory “update”.

After the SD card is inserted, U-Boot should be stopped at the console after power-up. To manually start the update, enter the following command:

```
run update
```

In the case of a U-Boot update, only the standard SPI boot flash is updated.

The script “netupdate” tries to load a U-Boot script “update/update” from the server. If found, it is loaded to memory and executed as in the case of the SD card.

As the script “netupdate” requires access to a server, the environment variable “serverip” must be set correctly. Alternatively, it is possible to use the “dhcp” or “bootp” commands.

An automatic run of the update script at every startup takes place if the update script is started in the preboot environment variable:

```
setenv preboot 'run update'
saveenv
```

6.11 Recovery Mechanism

The are two SPI boot flashes available with each device holding a copy of U-Boot. In case the contents of the standard SPI boot flash have been corrupted (e.g. as a result of a power failure during an update), the IPMI subsystem detects the problem, switches the flashes and restarts the CPU. The board starts from the recovery SPI boot flash. In this state, the standard SPI boot flash can be programmed again with the “update” or “netupdate” scripts described in the previous Chapter “6.9 Update”.

The update scripts provided ensure that prior to the update the standard SPI boot flash is selected and the U-Boot update image is available and correct.

The contents of the recovery SPI boot flash should never be updated in order to avoid a completely inoperable system with no accessing capability.

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