VIMOS SOFTWARE FAMILY

Using VIMOS on TI camera

1 March 2006

Thank you for your interest in our Vision Inspection and Optical Measurement System (VIMOS). In this manual you will find out how to install VIMOS system on TI camera.

Before going on reading the manual, we kindly ask you to read the following

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CONVENTIONS USED IN THIS MANUAL

INFORMATION. This sign marks section in the manual, which is for information only. You can decide to read or skip this section.

ATTENTION. This sign marks section of the manual, which is particularly important for the general understanding of VIMOS. Please, make sure to read this section before proceeding with reading the manual.

TIPS & TRICKS. This sign marks a Tips & Tricks section. Here you can find some practical advises on using the system or get a more detailed explanation of some features. Reading this section may help you in solving a particular problem or give you some ideas but is not vital for understanding VIMOS.

PREMISE. This sign marks a section, which requires you to do something before proceeding with reading the manual. Usually this is a demo program, you have to run or something similar.

File	*Menu item*
File > Open	*Sub-menu item or dialog control*
"1.1 About"	*Section reference. If the section is within the current manual no manual name is specified. When the section is within external manual the name of the respective manual is also included.*
`Ctrl+E`	*Hot-key combination. The first part of the combination specifies which system key to use. Possible values are: Ctrl, Alt, Shift. The second part specifies the normal key to be used in the combination. The plus sign means that you should press these keys simultaneously.*

CONTENTS

1. Introduction

VIMOS is a machine-vision system – it uses digital technology to perform visual tasks such as inspection, measurement, quality assurance and control of visual quality parameters. VIMOS runs on intelligent cameras manufactured by Vision Components, Germany. The cameras are based on DSP processors (CPUs) from Analog Devices (**ADSP cameras**) and Texas Instruments (**TI cameras**). The cameras have flash memories, which replace the hard disk of the PC.

> **INFORMATION**. *The flash memory is a non-volatile memory, which means data is preserved when the power is switched off.*

This manual provides detailed information on how to install, register and use VIMOS on a TI camera (VC20xx, VC40xx) with video-output hardware - i.e. a camera which can display the live picture received by the sensor on a monitor. The TI cameras are the most powerful ones and should be used when the system performance is critical. Some models (VC20xxE, VC40xxE) are equipped with an Ethernet interface and can be connected to a LAN. Some TI cameras have optional MMC (multimedia card) or SD cards, which expand the standard flash memory. The VIMOS system can be installed in the standard flash and/or in the MMC.

The manual also contains information about camera resources, flash files and various useful tips when working with VIMOS on TI camera.

Chapter 2 describes how to install VIMOS on TI camera. It presents information about camera drives and VIMOS files, which should be installed:

- Read section "2.2. Installing VIMOS files on FD drive" to learn how to install VIMOS on camera without MMC (**VC2028**).
- Read "2.3. Installing VIMOS files on FD and MD drives" to learn how to install VIMOS on camera with MMC (**VC2038, VC2065**).
- Section "2.4. How to load files to camera" describes how to transfer PC files to TI camera by the VIMOS Simulator (preferred) or by a terminal.

Chapter 3 describes how to register VIMOS on camera.

Chapter 4 describes how to start VIMOS on camera.

The last chapters discuss various aspects of the TI camera features, which concern VIMOS usage.

> **ATTENTION**. *A description how to work with VIMOS kernel – the system module, which actually does the image-processing, and which is a platform-independent module, can be found in the manual "Using the VIMOS Kernel".*

2. VIMOS installation

The installation of VIMOS on TI camera includes two steps:

- Loading of MSF files into flash memory (MSF is a special file format accepted by the cameras).
- Registration, which permits the execution of the VIMOS kernel on the camera.

Different camera models have different hardware configurations. Each configuration requires specific distribution files and installation procedure,

TI cameras have usually standard flash with size 2MBytes (32 sectors x 64Kbytes). The first 16 sectors are reserved for the operating system of the camera. The remaining free space of 1MByte is used for custom files. The standard flash is called the **FD drive**. It is fast, but needs regular packing when rewriting files (see "6.2. Flash packing" for more details).

Some TI cameras are equipped with an optional multimedia card MMC, which provides additional non-volatile memory with size 8 Mbytes or more. The MMC card is called the **MD drive**. It is slower than FD, but does not need packing.

For example VC2038 has both standard flash and MMC. VC2028 has only standard flash but is cheaper.

A VIMOS system, created for TI camera, is composed of the main executable module **vm.exe**, several data files and one executable registration module. The free space in the FD drive is not large enough for all VIMOS files in uncompressed form. There are two standard installations, which solve the problem:

- **On cameras without MMC like VC2028**. All files are loaded to FD and **vm.exe** should be in a compressed MSF file **VMC.MSF**. This installation is not possible on older TI camera models, which do not support execution of compressed programs. See "2.2. Installing VIMOS files on FD drive" for details.
- **On cameras with MMC like VC2038**. The data files and the registration module are loaded to FD. The main executable module **vm.exe** is contained in uncompressed MSF file **VM.MSF** and should be loaded to MD. Further you can configure VIMOS to copy and use all data files on MD. See "2.3. Installing VIMOS files on FD and MD drives" for details.

2.1. VIMOS distribution file

A VIMOS system for TI camera is usually distributed in a ZIP file with name `Vxyys_Tvvv.ZIP`, where:

`xyy`	VIMOS version `x.yy`
`s`	Optional VIMOS sub-version letter
`vvv`	Version of VCRT libraries used to create VIMOS

Examples:

`V252_T508.ZIP`	VIMOS version 2.52 created with VCRT 5.08 libraries
`V261b_T518.ZIP`	VIMOS version 2.61b created with VCRT 5.18 libraries

Typical contents of a VIMOS distribution ZIP file:

File	Description
VM.MSF	Uncompressed MSF file with the main VIMOS executable module **vm.exe** (the VIMOS kernel).

VMC.MSF	Compressed MSF file with the main VIMOS executable module **vm.exe** (the VIMOS kernel).
VMSYS.MSF	MSF file with merged VIMOS data files and the registration module ent_key.exe.
VMEXEC.MSF	VIMOS starting module, used when **vm.exe** is installed on MD.
VMAUTO.MSF	VIMOS autoexec file, used to start VIMOS kernel on camera power on,
VCTIO.MSF	VCTIO program used by the Simulator or by some atto-System terminals to transfer files between PC and camera.
STRC.EXE	String compiler – a PC program used to generate string file with texts for GUI tools.
TI_USER.TXT	Text file with latest information not included in the manuals (optional).

Further in this manual you will learn which files should be installed on camera and how. Some files are needed for a given type of installation only. Some files are utilities, which do not need to be used in the first installation. For example:

- Load **VMAUTO.MSF** to FD before you start using VIMOS in stand-alone mode in a factory environment and VIMOS should be started automatically on camera power on.

- You may use the DOS program **STRC.EXE** when you need to generate string file for GUI tools you have put in your user-program.

- **VCTIO.MSF** should be loaded to FD drive if you are going to install the main executable module **VM.MSF** on MD. We recommend using it in all installation procedures (for the FD drive as well) because it increases significantly the transfer speed.

2.2. Installing VIMOS files on FD drive

All VIMOS files should be loaded to FD when the TI camera has no MMC. You must install the compressed VIMOS executable module. Your TI camera must support execution of compressed modules (ask the camera provider).

Load **VMC.MSF** and **VMSYS.MSF** to FD. The recommended flash space-saving procedure is:

- Load **VCTIO.MSF** to FD (optional). This will increase the transfer speed. Skip this step If there is not enough flash space for the remaining modules – erase flash and start from the next step.

- Load **VMSYS.MSF** to FD drive.

- Register VIMOS, delete the **ent_key** module from FD and pack the flash (see chapter "3. VIMOS registration").

- Load **VMC.MSF** to FD. Note: On FD the compressed file **vm.exe** is seen with name **vm.128**. Uncompressed executable files are seen with extension **000**.

- Delete the **vctio** module if installed.

Read section "2.4. How to load files to camera" to learn how to load MSF files to camera.

> **ATTENTION**. *Remember that you need additional space for system configuration file* ***ini.vm****, user programs files and other files, which should be loaded to FD or which are created by VIMOS. With this type of installation you have about 200 Kbytes free space for user files. You need to perform regular packing of the flash by dynamic execution of the "Delete and pack" tool in run-mode and/or by packing the flash on VIMOS exit (see 6.2. Flash packing" for more details).*
>
> *In case of flash overflow, you should use TI camera with multimedia card and VM.MSF should be loaded to MD (see next section).*

2.3. Installing VIMOS files on FD and MD drives

If your TI camera has MMC card, we recommend installing VIMOS on both drives. This may be the only possible choice for future VIMOS releases when VIMOS may become too large to fit entirely in the1-Mbyte FD free space. This limitation however may disappear for future camera models with flash size greater than 2Mbytes.

The installation procedure is:

- Load **VCTIO.MSF** to FD drive.
- Load **VMSYS.MSF** and **VMEXEC.MSF** to FD drive. **VMSYS.MSF** contains merged VIMOS data files and the registration module **ent_key**. **VMEXEC.MSF** contains VIMOS starting module with the name of the main VIMOS program "***vm***", which starts the VIMOS kernel from the MD drive.
- Load **VM.MSF** file to MD.

Read section "2.4. How to load files to camera" to learn how to load MSF files to camera.

2.4. How to load files to camera

Section "2.4.1. Using the Simulator" gives all the information on how to load MSF files on TI camera. The Simulator provides all means needed to install and work with VIMOS on camera and you may skip reading sections "2.4.2. Using the VCT terminal" and "2.4.3. Using a general-purpose terminal". These sections are intended for VIMOS users, which want to learn more about the camera operating system and how to load and run other camera programs.

Using a general-purpose or the VCT terminal, you are able to communicate with the camera shell – you enter commands (texts terminated by the Enter key) and the camera returns on the terminal its response.

INFORMATION. Simulator versions 2.60 and higher have a built-in terminal, which may be used to load MSF files to camera and enter shell commands.

2.4.1. Using the Simulator

Start the Simulator, select **Camera > Camera Files Functions…** or press the toolbar button to open the **Camera Files Functions** dialog. Setup for loading files by the following operations:

- Select a COM port (you should know which COM port of the PC is connected to camera, this is usually COM1). Select baud rate (default = 9600). For Ethernet cameras VC20xxE/VC40xxE you should select TCP and enter IP address (the default is 192.168.0.65).
- Press the **Find Camera** button to check PC-camera connection. Remember that on serial cameras the baud-rate is set to 9600 after power-on. The simulator must find the camera without error messages and display a list of flash files (the list may be empty). In case of problems, switch the camera off, then switch on, wait several seconds for camera boot and try again. If the camera has AUTOEXEC file, which starts a program on power-on, press the "**Wait boot…**" button before switching the camera on.
- To ensure enough space for the VIMOS kernel, erase all files in the camera flash by the **Clean Camera** button. The file list should become empty.
- Set 115200 baud rate to enable fastest transfer speed (optional for serial cameras). If you have problems with this speed, set lower baud rate.
- Select the FD drive - **Flash EPROM (fd:)** if it is not the default drive.

- Load **VCTIO.MSF** to FD drive. This program is necessary to load files to both FD and MD. If you don't load this file you won't be able to load files directly to MD. The *vctio* module provides much faster transfer speed compared to the standard loading operations without it. You may skip this step if you don't need to load MSF files to MD. You will need however this module if you want to transfer other files to/from MD by the Simulator.

Load MSF files to camera by the **Send MSF** button. Press the button and select the MSF file you want to load. Remember that before you start a loading operation, you should have selected the correct destination drive – FD or MD.

If you are installing all VIMOS files on FD drive, the installation steps are:

- Load **VMSYS.MSF** to FD drive.
- Load compressed **VMC.MSF** to FD drive.

If you are installing VIMOS files on FD and MD drives:

- Load **VMSYS.MSF** to FD drive
- Load **VMEXEC.MSF** to FD drive.
- Select drive **Multi-media card (md:)**.
- Load uncompressed **VM.MSF** to MD drive.

Now you are ready to register VIMOS and to start the VIMOS kernel on the camera. Refer to "Using the Simulator" manual for more information about the "Camera Files Functions" dialog or other Simulator functions.

2.4.2. Using the VCT terminal

VCT is a DOS terminal program developed by atto-Systems for work with serial VC cameras and VIMOS. It is more convenient than general-purpose terminals especially for loading of MSF files to camera, writing or reading other files to/from camera and changing baud-rate. You may use VCT to work with VIMOS kernel on camera or to load and run other camera programs. The terminal works with ADSP-based and TI-based cameras..

This section describes how to load MSF files using the VCT terminal. You should follow the installation procedures described above and load respective MSF files. We recommend erasing the standard flash by the **er** shell command before you start loading the MSF files.

Enter **Alt-P** to set correct serial port settings – COM port (usually COM1), no parity, 8-bit word, 1 stop bit, baud rate 9600. Check communication by pressing Enter - you should receive the prompt '**$**' each time

Enter **Alt-L** command to open the **Load MSF file** window. This window is used to load MSF files to FD and MD drives. The window commands are:

- **F1** = Select load mode: ASCII or BINARY. On TI camera this option is enabled when F3 = None. Use ASCII load mode because TI cameras do not support binary loading by the "lo -b" shell command.
- **F2** = Select baud rate, used during the transfer. The terminal returns to current baud rate when the transfer is over.
- **F3** = Select destination drive by one of the following options:

  None   Load MSF file to the standard flash (FD drive). Use this option for standard MSF file loading to all ADSP and TI cameras by the **lo** shell command. Set F1 to ASCII mode on TI camera.

  FD   Load MSF file to the standard flash (FD drive) using the *vctio* program. Fast loading in mixed binary/ASCII mode for serial TI cameras (the F1 setting is ignored).

  MD   Load MSF file to the multimedia card (MD drive) using the *vctio* program. Fast loading in mixed binary/ASCII mode for serial TI cameras (the F1 setting is ignored).

The last two options in the **F3** command are valid on TI cameras only. You should have previously loaded VCTIO.MSF in mode F3 = "None". After setting transfer options, enter name of MSF file and press Enter to start transfer. During the transfer you will see a progress bar on the bottom terminal line.

Further in this manual you can find instructions on how to handle data files on MD drive.

2.4.3. Using a general-purpose terminal

You can load VIMOS MSF files (or other MSF files) using a general-purpose terminal like the Windows program **HyperTerminal** or the DOS program **PROCOMM**. Remember that currently you can't load MSF files directly to the MD drive.

A VIMOS installation procedure on FD and MD drives is described below:

- Set correct serial port settings – COM port (usually COM1), no parity, 8-bit word, 1 stop bit, baud rate 9600. Check communication by pressing Enter - you should receive the prompt '**$**' each time.

- If the camera has AUTOEXEC file, which starts a program on power-on, you may not see the shell prompt. Switch camera off, press **Esc** key and switch camera on. Hold the key down until you see the camera boot message. This method can be used on serial cameras only.

- Erase (format) the standard flash (the FD drive) by the **er** shell command. Remember that the Enter key should terminate each shell command.

- Upload VM.MSF (or VMC.MSF). Enter the "**lo**" command and follow the instructions for file uploading of the respective terminal (use ASCII protocol, no hardware handshake). When the uploading operation is finished, you must see the file vm.000 by the **dir** command (file extension ".000" == ".exe"). In case of FD overflow you should use direct loading of VM.MSF to MD drive, which is supported by the Simulator or the VCT terminal.

- Copy vm.exe from FD to MD by the following commands, supposing your current drive is FD:

Shell command	Effect
del md:/vm.exe	Delete previous version of VIMOS kernel from MD drive (needed when overwriting existing files on MD).
copy vm.exe md:	Copy vm.exe to MD. You will see vm.exe file on MD by the **dir md:** command.
del vm	Delete vm.exe from FD
pk	Pack FD drive

- Load VMSYS.MSF and VMEXEC.MSF to FD drive.

- Register VIMOS (see next section). After VIMOS registration the module **ent_key** is no longer needed and you may delete it by the **del ent_key** command.

> **INFORMATION**. *You can replace the above operations by a direct loading of VM.MSF to MD by the Simulator or the VCT terminal (both need the VCTIO program, loaded to FD).*

2.5. Installing custom logo on camera

On cameras with video output, VIMOS displays a system logo in the upper right corner of the overlay picture. You can replace the default logo by a custom logo by the following operations:

- Create a monochrome bitmap file with a custom logo picture. The width of the logo image in pixels should be a multiple of 16 for ADSP cameras.

- Run the batch file GENLOGO.BAT, which is contained in the software package:

```
GENLOGO {-cam|-ticam} bmp_file
```

where:

-cam   Generate output file for ADSP camera

-ticam   Generate output file for TI camera

  bmp_file *N*ame of the monochrome bitmap file.

 The batch file generates the file LOGOA.MSF. The batch file executes several DOS programs from the software package – BMP2BIN.EXE, BCONV.EXE and SCVT.EXE. Run the batch file in a folder, where you have access to these programs.

- Load LOGOA.MSF to the camera flash by the Send MSF function of the Camera Files Functions dialog.

- Start VIMOS Kernel on camera. The custom logo will replace the default logo in the overlay screen.

You should install a custom logo after the standard VIMOS installation on the camera.

3. VIMOS registration

After successful installation of the VIMOS files on the camera you should register the system to enable execution of the VIMOS kernel. Send the serial number of your camera to the software supplier and receive a VIMOS key. Remember that you are able to register VIMOS when VMSYS.MSF has been loaded to FD drive.

Start Simulator, open the **Camera Files Functions** dialog and perform the following operations:

- Select drive **Flash EPROM (fd:)**.
- Paste the VIMOS key into the **Vimos Key** field.
- Press the **Set key** button.

Refer to "Using the Simulator" manual for more details about the "Camera Files Functions" dialog. Another possibility for VIMOS registration is a direct invocation of the **ent_key** module using a terminal.

*TIPS & TRICKS. Erase the **ent_key** module after VIMOS registration to save FD space. Select **ent_key** in the file list by a left click and press the **Delete selected** button. Wait for the end of the delete operation and then press the **Pack Flash** button to pack FD.*

ATTENTION. If you erase camera flash and reload kernel files, you must re-enter the registration code.

4. Starting VIMOS kernel on the camera

Start Simulator and select **Camera > Start Camera Vimos** or press the toolbar button to start VIMOS kernel on camera. The mouse cursor will disappear from the PC monitor, but mouse commands are captured and sent to camera. You can switch between "Capture Mouse" mode and Windows GUI mode (visible mouse cursor) by `Alt+M`.

If you have installed VIMOS on MD, you should wait about 15 seconds while the camera is loading VIMOS from MD (the message "Please wait while VIMOS is loading…" is displayed on the camera monitor). When the kernel is started you will see a system logo picture with the VIMOS version. The system logo is displayed while VIMOS is initializing. When the system logo disappears, the kernel is ready to receive your commands by the mouse.

INFORMATION. You can start VIMOS kernel using the VCT terminal. Start the terminal in full DOS window and:

- *Set 1200 bauds by **Alt-F1**.*
- *Capture mouse to send mouse commands to camera by **Alt-M**.*
- *Enter `vm` and press Enter key.*

ATTENTION. To ignore current I/O settings, which disable mouse usage (other I/O device), and regain control over the system by the mouse, you should:

- *Start VIMOS via Simulator or VCT terminal.*
- *Don't move the mouse while the logo is displayed until the message "Searching mouse" appears on the camera monitor. Up to that moment the mouse driver in the kernel performs initial mouse recognition, which is specific for the TI camera.*
- *After that message move the mouse to force recognition of the mouse.*

On serial cameras VIMOS sets camera baud rate to 1200 for work with mouse. On exit VIMOS restores default baud rate of 9600.

5. VIMOS files on the TI camera

This chapter presents some conventions used for VIMOS file names. There are some differences between VIMOS file names on ADSP and TI cameras. Read "*6.1. The TI camera file system*" to learn more about the file system of the TI camera.

All VIMOS data files receive default extensions `".002"` on FD and `".dat"` on MD drive. Complex file names like `"up0.vm"` receive additional extension `".dat"` and become `"up0.vm.dat"`. Examples:

```
fd:areaa0.002          md:areaa0.dat
fd:ini.vm.002          md:ini.vm.dat
fd:/user/up1.vm.002    md:/up1.vm.dat
```

Usage of file names when working with terminal:

```
del areaa0             valid on FD
del areaa0.002         valid on FD
del ent_key            valid on FD
del ini.vm             invalid
del ini.vm.dat         valid on FD and MD
```

5.1. Configuring VIMOS to work with MD drive

This section describes how to select MD or FD for a default working drive – the drive, which is used by VIMOS kernel to read and write user-programs files, images, point-list files, etc. You should have basic knowledge on how to work with VIMOS kernel (see "Using the VIMOS Kernel" manual).

By default (after installation) VIMOS works with data files on FD, which is faster than MD. In this mode you should regularly pack the flash (see 6.2. Flash packing" for more details). When FD can't hold all data files, you should configure VIMOS to work with VIMOS data files on MD drive. Using MD as a default file drive has the following advantages:

- You receive much greater space for your files (8 Mbytes or more).
- You don't need to perform regular drive packing.

ATTENTION. The MD drive has one disadvantage – it is much slower than FD. If you are accessing file(s) in your user program and the file I/O tools are executed in a loop, you may encounter low VIMOS performance. You may prefer to keep FD as default drive in this case.

The configuration procedure is:

- Start VIMOS kernel on camera and enter edit mode.
- Select **Edit main menu > Configuration > General-purpose...** and open the "**General-purpose configuration**" dialog. Use the "**Default file drive**" toggle to change the default drive from FD to MD. Close the dialog and exit VIMOS. Remember that second opening of this dialog will show the current but not the new default drive - changes become valid on VIMOS restart. On exit VIMOS copies the following system files from FD to MD: `vmgui`, `vmgimd`, `vmlogo`, `vmlogol`, `logoa`, `logob`, `key.vm` and the system configuration file `ini.vm`.

When started next time, VIMOS kernel searches the file `ini.vm` on MD. If not found, FD remains the default drive. If found, MD becomes the default drive and all data files, used by the system (system data files, user-programs, calibration data, image data,...), are read from and written to MD drive.

All user data files (user-programs, …) should be copied from FD to MD before you start to work with the new default drive. This can be done in two ways:

- By the "**Camera Files Functions**" dialog of the Simulator if you have copies of all user data files on PC. Select drive **Multi-media card (md:)**. Press the **Send** button and select a PC user-program file, which should be transferred to camera. Remember to enter correct camera name (up0.vm for example). Repeat this operation for all user-program or other files, used by VIMOS kernel on the old default drive FD. Note: Image files should be transferred in "**Image file**" mode. All other files should be transferred in "**Binary data**" mode.

- By copying needed files from FD to MD drive. This could be done by camera shell commands, issued from a terminal (possibly in a batch file). Example:

```
del md:up0.vm.dat
del md:up1.vm.dat
del md:areaa0.dat
. . . . . . . . .
copy fd:up0.vm.dat md:
copy fd:up1.vm.dat md:
copy fd:areaa0.dat md:
. . . . . . . . . . .
```

ATTENTION. The main VIMOS module vm.exe may be located on FD or MD. All external exec modules (exec1,exec2,...) must be located on FD drive.

5.2. Switching default drive from MD to FD

Set default drive from MD to FD by the following operations:

- Start VIMOS and enter edit mode.
- Select **Edit main menu > Configuration > General-purpose...** and open **the "General-purpose configuration**" dialog. Use the "**Default file drive**" toggle to change the default drive from MD to FD. Close the dialog and exit VIMOS. The system deletes ini.vm from MD and saves ini.vm on FD. Note: VIMOS expects that system data files like vmgui, vmgimd,... are kept on FD drive.
- Restart VIMOS.

All user data files (user-programs, …) should be copied from MD to FD before you start to work with the new default drive (the reverse operation of the one described in the previous section).

ATTENTION. An emergency way to switch the default drive from MD to FD is to erase ini.vm from MD.

6. TI camera features

This chapter presents information about TI camera features – the operating system, the file system and some hardware features, which concern VIMOS operation.

6.1. The TI camera file system

The next sections present some general information about the file system of the TI camera. If you are using a terminal, you should read this chapter to learn how to work with flash files. Refer to Vision Components documentation for more details.

6.1.1. Drives and directories

The TI camera has one or two drives called **"fd"** and **"md"**. The file system of the camera supports directories on both drives. The default FD directory for user files is **fd:/user/**. The default MD directory for user files is **md:/**. As you see file paths are defined in UNIX manner by the forward slash '/'. Change current drive by the **cd** command, for example "**cd md:"**.

Examples with the **dir** command:

```
dir                    Shows all files in the current directory of the current drive
dir fd:                Shows all files in the current FD directory
dir fd:/user/          Shows all files in the specified FD directory
dir fd:/sys/           Shows all hidden system files (equal to dir –x)
dir md:                Shows all files in the current MD directory
dir md:/               Shows all files in the root MD directory
```

6.1.2. File names and extensions

The file system supports file names with max length of 8 characters excluding the extension "**.xxx**". The file type (extension) is part of the file name - thus the maximum length of the file name is 12 characters. For compatibility with older versions of the operating system, on FD drive you can see only numeric file extensions (as shown by the **dir** command). MD files have normal text extensions. The file system automatically converts numeric types to text types and vice versa when you use a file name in a shell command.

```
.000 <==> .exe
.001 <==> .asc
.002 <==> .dat
```

For example the file `datafile.002` can be referenced by the name `datafile.dat` on FD drive although the **dir** command shows `datafile.002`:

```
copy fd:/user/datafile.dat md:
```

Some shell commands like **copy** require a full file name with drive, path and extension (type). Other commands like **del** do not need file extension on FD drive, but need full path on MD drive. Default directory names may be omitted. Examples:

```
copy fd:/user/datatfile.dat md:/xxx.dat
del  md:xxx.dat
```

File extensions may not be entered when deleting FD files. The following command will delete the file `xxx.000` from current drive FD:

```
del xxx
```

6.1.3. Copying files to MD drive

Copying into existing MD files is not possible when using the shell command **copy**. Delete MD files before overwriting them.

6.1.4. Drive capacities, checking available drive space

The available space for user files on FD drive is 1 Mbyte (16 sectors). The "Camera Files Functions" dialog of the Simulator shows the current free space on FD in the "**Free Flash**" field. Using a terminal, you can see the free flash space by the "`mem -f`" shell command.

The total available space of the MD drive depends on the capacity of the installed MMC card (8 Mbytes or more). On cameras with the latest operating systems (VCRT 5.18 and above), the "**dir**" shell command shows the free MD space in hex format. Note that the Simulator always shows the free FD space, no matter which is the current drive – FD or MD.

6.2. Flash packing

The standard flash memory of the TI camera (the **FD** drive) has some peculiarities, compared to the hard disk of the PC. The file system of the camera rewrites existing files in the free area of the flash. The area, where a previous copy of the file resides, is not freed and it can't be used until a pack operation of the flash is performed. The same rule is valid when deleting files. Thus, after continuous work with the flash, a moment comes when the flash overflows.

> *INFORMATION. This problem is caused by the electrical properties of the flash PROM chip. The flash memory is organized in sectors of 64K bytes. Files are stored sequentially in the flash memory without gaps and several files may reside in one sector. To overwrite one byte in the flash memory, it is necessary to erase the whole sector the byte belongs to.*

When working with VIMOS on FD drive, you should perform regular packing of the drive. This can be done in one of the following ways:

- Before exit, VIMOS kernel prompts for a flash packing operation. If the flash is about to be full (for example less than 64K bytes remain free), exit VIMOS by packing.

- Another possibility is to enable automatic flash packing by the "General-purpose configuration" dialog. On TI camera all VIMOS operations in edit mode, which write files to flash, are followed by a flash packing operation (including the exit from VIMOS kernel).

- You may perform dynamic packing during the execution of the user-program by the "Delete and pack" tool. This method should be used if VIMOS kernel works for a long time without interruption.

- The flash can be packed in non-VIMOS environment by the Simulator (see the "Camera Files Functions" dialog) or by the "**pk**" shell command of the camera when using a terminal program.

The MMC card (the **MD** drive) needs no packing. Here the sector size is 512 bytes and each file occupies a number of whole sectors (as the clusters in the PC hard disk). The much smaller sector size allows overwriting of files by erasing of occupied sectors and writing of new data into erased sectors.

6.3. PLC input and outputs of TI camera

The TI camera has 4 input digital lines (IN0-IN3) and for 4 output digital lines (OUT0-OUT3), called **PLC** inputs/outputs. Each line can hold one digital value: 0=OFF (inactive) or 1=ON (active). VIMOS uses these lines to receive information from the outer world (trigger signals for example) and to pass control signals as a result of its operation. VIMOS has tools, which read input PLC lines and write output PLC lines.

The table below shows the electrical properties of the PLC lines of the TI camera:

PLC line	ON / OFF line voltage
IN0-IN3	0=no voltage 1=voltage present
OUT0-OUT3	0=no voltage 1=voltage present

6.4. VC40xx features

The VC40xx family of cameras represents the latest generation of TI-based cameras with typical representatives VC4038E, VC4065E and VC4066E. Compared to VC20xx, they have faster processors, larger memories and more I/O ports. The table below compares some basic features of VC20xx and VC40xx:

Camera feature	VC20xx	VC40xx
CPU	150 MHz TMS320C62xx	400 MHz TMS320C64xx
Standard flash memory	2MB (1MB available)	4MB (3MB available)
Image/data/program memory	16MB SDRAM	32MB SDRAM
I/O ports	100MBit Ethernet	RS232 serial port + 100MBit Ethernet
Optional memory card	8-16MB MMC card	128MB SD card

6.5. Virtual screen on Ethernet cameras

VIMOS on Ethernet cameras VC20xxE/VC40xxE supports sending of combined video/overlay picture (called virtual screen) to the Simulator (refer to "*Using the Simulator*", chapter "*4.5. Virtual screen*" for more details). Remember that this mode decreases the execution speed of the system on the camera and should be used usually for diagnostic purposes only.

7. VIMOS performance on the TI camera

This chapter presents some recommendations to improve the VIMOS performance on TI-based cameras.

- Use faster cameras like VC40xx or FA45, based on 400 MHz processor.
- The best performance of VIMOS on TI camera is reached in "Show" run mode (i.e. not "Live" mode as it is on ADSP cameras with video-output). This mode disables the automatic image taking in the main system loop and you should put a "Take image" tool in your user-program.
- If you don't need to see tool representations in the overlay, you can save execution time by disabling the VIMOS drawings. This can be done only in the kernel – enter edit mode and then enter **Edit main menu > Configuration > Set run-mode type**. Set the parameter **Draw** to **OFF**.
- If you need to see the tool drawings, you can save time by using a zero or a very small anti-flicker delay time. Remember that this method may spoil the overlay picture especially on fast cameras from the VC40xx family. The next section gives more information about the overlay blinking problem.
- Another method to improve the system performance is to use parallel picture taking and program execution, which is controlled by the "Take image" tool.

Approximate time for module reloading when VIMOS executes external EXEC and all files are located on FD drive is 10 ms (without the processing time of the EXEC module itself).

7.1. The overlay blinking problem

VIMOS uses fast overlay drawing techniques via the so called "ping-pong" (or "double buffer") method via two overlay pages. In a given system cycle one of the pages is active and displayed on the monitor, while the system draws in the second page. In the next cycle the pages are switched, the second page becomes active (i.e. displayed on the monitor) and VIMOS draws in the first page.

Due to some peculiarities of the camera's video-output hardware, the camera does not display immediately each new overlay page when the page is changed by VIMOS and you may encounter overlay screen blinking when running VIMOS. The blinking can be removed by a non-zero value of the "**Anti-flicker delay**" configuration parameter, which synchronizes the overlay display with the setting of new overlay pages. This parameter is present as a user-program property in the Editor. It can also be set in the VIMOS kernel from **Edit main menu > Configuration > General purpose…**

The delay parameter can receive values from 0 to 27 ms (0=delay is disabled). The delay value should be chosen depending on the camera model and on the frequency of the monitor. If you have blinking on your camera with zero delay, attempt to find the minimum delay value, which removes the blinking (it may vary on different camera models). Usually you don't need to set delay on VC20xx cameras, but you may need to set it on VC40xx. A delay time of 10 ms for example does not mean that each system cycle is delayed by 10 ms. This is the maximum wait time when the system encounters a given condition (the system variable DISP_CNT==1) and waits for this variable to change. This condition is not met in every instruction cycle. Typical wait times in several sequential system cycles are for example 0, 0, 0, 10 – i.e. the average system delay is about 2-3 ms per cycle.

The anti-flicker delay is also disabled when you disable globally all drawings in run mode by **Edit main menu > Configuration > Set run-mode type** : Draw=OFF.